

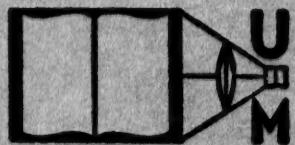
Vol. XVII

No. 7

DISSERTATION ABSTRACTS

*ABSTRACTS OF DISSERTATIONS AND
MONOGRAPHS IN MICROFORM*

UNIVERSITY MICROFILMS
ANN ARBOR, MICHIGAN: 1957



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INTRODUCTION

This year *Dissertation Abstracts* will carry, as the 13th issue of Volume XVII, an index to all doctoral dissertations published in the United States and Canada. This issue will be titled *Index to American Doctoral Dissertations*, and will be a continuation of *Doctoral Dissertations Accepted by American Universities*.¹ The joining of these two reference works makes it possible for librarians to have an integrated bibliographical research tool relating to doctoral dissertations under one cover.

Dissertation Abstracts will continue to provide abstracts of dissertations by recipients of doctoral degrees from graduate schools cooperating with University Microfilms in the publication of complete dissertation texts on microfilm, on Microcards, or as microprint. At the end of each abstract will be found an indication of the number of pages in the original typescript and the Library of Congress card number, for the convenience of scholars and research workers. In some instances *Dissertation Abstracts* will be found to be an adequate substitute for the published dissertations.

The *Index to American Doctoral Dissertations* will be a complete indexed listing of dissertations by students who were granted doctoral degrees during the previous academic year, and including those abstracted in *Dissertation Abstracts*, arranged by degree-granting institutions under appropriate subject headings. An alphabetical author index will be included.

The tabular material which has been an established part of its predecessor volume will be included in full, so arranged that statistical summaries can be maintained with no break in continuity.

It is hoped that those who use *Dissertation Abstracts* will continue to make suggestions for its improvement, as these are vital to its continued life and growth. Several suggestions for changes in the headings used for indexing purposes have been received, and a committee of the Association of Research Libraries is reviewing the indexing system at the present time as a result of these suggestions.

¹Arnold H. Trotier and Marian Harman, (eds.), *Doctoral Dissertations Accepted by American Universities*. (New York: H. W. Wilson Co., 1933-1955.)

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AGRICULTURE

AGRICULTURE, GENERAL

AN ANALYSIS OF THE USE OF ECONOMIC INFORMATION IN FARM PRODUCTION DECISIONS BY OHIO FARMERS

(Publication No. 21,431)

Riley Shelton Dougan, Ph.D.
The Ohio State University, 1956

A major problem of those working in agricultural policy is to determine the effectiveness of economic information in bringing about agricultural adjustments. To elucidate the problem, and evaluation was made of some of the methods used to give farmers economic information which should prove effective in bringing about production adjustments.

The general aim of the study was to delineate some of the forces which affect certain short-time production decisions of farmers, with special emphasis upon the sources and the value of economic information as a factor influencing these decisions.

The study was divided into three major phases. The first was concerned with delineating the major sources of economic information used by farmers, determining the familiarity of farmers with economic data and their economic situation, and finding to what extent such factors as price, labor supply, and alternative opportunities affect decisions involving enterprise size on farms. The second phase involved a comparison in changes in attitudes and practices of one group of farmers who had been presented with extra economic information and another group who had not. In the third phase, a more thorough analysis was made of two economic information publications of the Ohio Agricultural Extension Service, "Econogram" and Timely Economic Information for Ohio Farmers.

Farmers who furnished judgments and information concerning questions posed in the first two phases were parents of high school vocational agriculture students and members of evening adult farmer classes conducted by vocational agriculture instructors. In phase two, participating farmers from one-half of the departments were provided with added economic information which farmers in the other half were not given. After one year, differences in attitudes and practices of the two groups were analyzed. In phase three, all the farmers from randomly selected counties who received Timely Economic Information for Ohio Farmers and "Econogram" were asked to furnish data for more thorough analysis of the two publications.

It was found that although farmers had access to several sources of economic information and were in a general way familiar with past price trends and future expectations, price variation in a two-year period did not influence many producers to change the size of their major enterprise. Exposing a group of farmers to more economic information for one year did not appreciably change their attitudes and practices regarding business size.

Farm papers were the farmer's most important source

of economic information. Farmers had confidence in agricultural College and extension service publications, but most were not receiving them.

Such factors as labor supply, amount of feed on hand, and completion of an expansion program already under way were greater contributors to change in business size between two years than were short-time price changes. The number of producers who indicated that they would increase size of business with a sizable price rise was greater than the number who indicated that they would decrease size of business with a similar price drop.

The two publications which were analyzed were well accepted by those who received them. They liked the general format that was used, but wanted more emphasis upon price forecasting and shorter articles with greater variation in the number of items included in each issue.

The study forces the conclusion that better production adjustments by farmers would result from a concentrated effort to project information about the economic outlook for commodities as far into the future as it takes to bring alternative opportunities into production, an intensive program to help farmers understand how to use information profitably in making adjustments, and a greater use of such existing media of information as farm papers and agricultural extension service publications.

396 pages. \$5.05. Mic 57-2287

STUDIES OF THE MAGNESIUM STATUS OF SEVERAL PENNSYLVANIA SOILS

(Publication No. 20,956)

George Theodore Felbeck, Jr., Ph.D.
The Pennsylvania State University, 1957

An investigation was carried out to assess the magnesium status of several Pennsylvania soils in order to determine what factors, if any, were operating to limit the ability of various plants to obtain sufficient magnesium from such soils for normal growth.

The factors selected for study that influenced magnesium uptake by plants were the exchangeable magnesium content of the soil, the percent saturation of the exchange complex by magnesium ions, the soil pH, the structure of the soil as indicated by the percent material over 2 millimeters in diameter, the ratio of exchangeable magnesium to exchangeable potassium, the variation in the ability of different plant species to respond to magnesium added to the soil, the ability of okra to obtain magnesium from various magnesium-containing minerals, and the effect of added magnesium on the growth of potatoes on commercial farms.

The experimental program was carried out in four phases in order to evaluate individually the influences of these factors. First, a survey of 23 Pennsylvania soils was made to determine by laboratory analyses the exchangeable

magnesium content, pH, percent magnesium saturation, physical structure, and magnesium/potassium ratios. Second, a field plot experiment was established to determine the variation in the responses of several different plants species to magnesium added to the soil in a soluble form. Third, a greenhouse experiment was established to determine the ability of okra to extract magnesium from various minerals containing this element, and the effect of rate of application of the mineral, pH, and level of potassium on this extracting ability. Fourth, a field experiment involving eight commercial potato farms throughout the state was established to determine what responses were made by potatoes when a soluble form of magnesium was used as a soil amendment.

In the survey of the soils of Pennsylvania, only one of the 23 soils studied was classified as possibly deficient in magnesium in all four of the following categories: level of exchangeable magnesium, percent saturation, magnesium/potassium ratio, and limitation of root growth due to poor physical structure. This soil, the Mardin, was used as one of the sites for the study of the commercial growth of potatoes, and, since no response was obtained to added magnesium, it was concluded that some other factor was limiting the growth of potatoes on this soil.

In the study of species response to added magnesium, only one species, okra, showed definite deficiency symptoms that were associated with the level of added magnesium. No consistent responses were obtained in yield or rate of seed germination.

In the study of the ability of okra grown in the greenhouse to extract magnesium from minerals containing this element, it was found that asbestos and olivine provided no significant amounts of magnesium for plant growth. Processed brucite and dolomite provided insufficient amounts of magnesium to the plant under the conditions of the experiment. Freshly burnt dolomite and unprocessed brucite were nearly as satisfactory sources of magnesium for okra as were the soluble materials, Epsom salts and Sul-Po-Mag.

The pH level strongly affected the availability of magnesium from the partially soluble materials, brucite and dolomite and their derivatives. The rate of application of the carriers had an effect only when the carrier itself was soluble, and in this case the plant was able to utilize the additional magnesium.

An ionic antagonism was demonstrated between potassium and magnesium, which could be overcome by the addition of soluble potassium. Soluble magnesium depressed the absorption of potassium by okra, but the presence of soluble potassium in excess did not seem to depress the uptake of magnesium.

In a field study of the effects of soluble magnesium on the growth and quality of potatoes, no significant effects were obtained which could be attributed to the presence of this element.

136 pages. \$2.00. Mic 57-2288

FARM ENTERPRISE SELECTION BY LINEAR PROGRAMMING

(Publication No. 21,308)

Horace Lee Puterbaugh, Ph.D.
Purdue University, 1957

Major Professor: Earl W. Kehrberg

The development of new technologies in agriculture and the general complexity of farm business indicated that a mathematical procedure for farm organizational planning would be of benefit to farm managers. Such a procedure—linear programming—existed. The problem, therefore, was one of evaluating the use of this tool in practical farm management situations.

A careful study of the history of development and use of linear programming revealed that the assumptions of linear programming were precisely those made by farm managers using conventional budgeting. The assumptions of linearity and some limiting factor to create a limit to the production level of a particular enterprise have been made by farm managers for generations. All that had been lacking for linear programming was some orderly, mathematical procedure for stating such assumptions.

The numerical calculations of linear programming by the simplex method were studied—only simple arithmetic was needed to perform such calculations. The calculations of linear programming are far simpler in nature than those required for multiple regression analysis, for example. Likewise, the interpretation of “an answer” to linear programming calculations is of a direct nature—simple cost and income comparisons familiar to farm managers using conventional budgeting may be used.

Calculations do become long and tedious if a particular problem is expanded to a reasonable size, however. Therefore, linear programming was evaluated in this study using an electronic digital computer. Three farms were selected on the basis of their dissimilar physical and human resources for study in this farm management evaluation of linear programming and designated as case farms A, B, and C.

The three case farms representing differences in size, management, soils, and capital adequately tested the feasibility of linear programming as a farm planning procedure. Input-output data was adjusted for each farm to fit the individual problem presented.

Some difficulty in obtaining a solution with the electronic digital computer was encountered for case farm B. The enterprises considered as possibilities for this farm were highly competitive and lengthy calculations were necessary before an optimum solution was obtained. Certain restrictions (limiting factors) were exceeded in the final solution. It was believed that this difficulty was caused by loss of accuracy due to rounding. While no exact conclusion can be drawn on this point, it was noted that this error began to be significant after approximately three hours of calculations and 28 approximations had been made. A slight shift in the data enabled an optimum to be reached before this loss of accuracy became significant.

In all calculations for the case farms no final answer was sought for a particular problem in view of the number of unmeasured variables. Rather, analysis of a particular problem was desired. It was believed that no mathematical

procedure could provide an exact answer to problems involving human resources.

Fifty dollars per hour was charged for the use of the electronic digital computer and a total cost of approximately \$710.00 resulted from the total use made of this machine for nine sets of calculations.

As a result of the experience obtained from using linear programming procedures for the case farms, and analysis was made of the various relationships between inputs and outputs and between various enterprises regarding their adaptation to linear programming. A method of using linear programming for farm organizational planning within a type of farming area was outlined. This method involves the use of a master data tape with other tapes capable of inserting selected data for particular problems. This method would allow for variation in data for individual farms, but would not involve the preparation of new data tapes for each problem. 229 pages. \$3.00. Mic 57-2289

B-VITAMINS AND VITAMIN C LEVELS IN BLOOD AND MILK OF CATTLE UNDER DIFFERENT ENVIRONMENTAL TEMPERATURE CONDITIONS

(Publication No. 21,105)

Ranjit Singh, Ph.D.
University of Missouri, 1957

Supervisor: C. P. Merilan

The data were collected from Holstein and Jersey cows subjected for two to four weeks in a climatic laboratory to three different diurnally varying temperature rhythms — 40 to 70°F., 60 to 110°F., and 70 to 100°F. and from Brahman, Shorthorn and Santa Gertrudis calves maintained at constant temperatures of 50 and 80°F. in the climatic laboratory with a control group of each breed housed under ordinary conditions. The data collected from calves covered a period of one year.

Brahman and Santa Gertrudis calves in the climatic laboratory both at 50 and 80°F. had lower blood ascorbic acid levels than their controls in the open. The values for Brahmans at 50°F. were also consistently lower than at 80°F. Holstein cows had lower blood niacin levels in the 60 to 110°F. temperature rhythm than in that of 40 to 70°F. The Shorthorn calves at 80°F. had distinctly lower blood niacin levels than at 50°F. or in the open shed. The influence of high environmental temperature cycles on the concentrations of pantothenic acid in the blood of cows was variable for individual animals. Blood riboflavin levels for both Jersey and Holstein cows were highest in the low temperature cycle of 40 to 70°F., lowest in the high temperature cycle of 60 to 110°F. and intermediate in the 70 to 100°F. temperature cycle. Shorthorn calves at 80°F. had clearly lower blood thiamine levels than at 50°F.

There were no breed differences in the vitamin content of the blood of cows. Also there were no breed differences for calves maintained under normal conditions, except that Shorthorns had lower blood ascorbic acid levels than Brahmans and Santa Gertrudis. There was no definite relation between the blood vitamin levels of calves and their age and also there was no influence of season except that during

July, August and September all the calves had higher riboflavin values than during other periods of the year.

The ascorbic acid concentrations in the evening milk of all cows were lowest in the 40 to 70°F. temperature range, highest in that of 70 to 100°F., and intermediate in the extreme temperature range of 60 to 110°F. In general the niacin content of both morning and evening milk of Holsteins increased under the influence of both the high temperature cycles. The pantothenic acid content of both morning and evening milk of all cows generally decreased under the influence of the 60 to 110°F. temperature rhythm, but the effect of the 70 to 100°F. temperature cycle was variable for individual cows. The riboflavin levels for both morning and evening milk of Holstein cows were significantly increased under the influence of both the high temperature cycles, 60 to 110°F. and 70 to 100°F., however there was no material difference between the values in the two high temperature cycles. There was no regular or appreciable influence of environmental temperatures on the niacin and riboflavin values of Jersey milk.

The ascorbic acid content of evening milk for Jersey cows was found to be lower than that of Holsteins, while the riboflavin content of the Jersey milk both for morning and evening was higher than that of corresponding Holstein milk. There were no appreciable breed differences or diurnal variations for niacin and pantothenic acid levels in milk.

138 pages. \$2.00. Mic 57-2290

SOIL FACTORS AFFECTING THE GROWTH OF QUAKING ASPEN FORESTS IN THE LAKE STATES

(Publication No. 21,265)

Joseph Henry Stoeckeler, Ph.D.
University of Minnesota, 1956

The study involved the field classification of the soils on 104 plots of quaking aspen (*Populus tremuloides* Michx.) in northern Minnesota and northern Wisconsin. The major factors which affect the site index and growth were isolated. Laboratory analyses were performed on soils from the first 70 plots.

Site index, which ranged from 44 to 83 feet, predicted at age 50, was related to silt-plus-clay in the top three feet of soil, or of the A + B horizons. It was also affected by presence of shallow water-tables, repeat burns caused by forest fires, texture of parent material, gravel or stone content of the soil, and poor aeration and poor internal drainage as judged by depth to strong mottling. With the above information at hand the standard deviation of the site index was generally within ± 5 of the average. Using soil type as a basis of classifying sites, the standard deviation was ± 4 feet for soil types represented by 5 or more plots.

When site index was related to mechanical properties of soils such as silt-plus-clay content, moisture equivalent, or content of 5- or 2-micron fractions, the correlation coefficients were in the range of .592 to .894, and usually in excess of .700. They were usually significant at the 1 percent level, and invariably significant at the 5 percent level.

When site index was related to individual chemical

properties of soil, the correlation coefficients of those which were significant (mostly at the 5 percent level) were in the range of .430 to .632. Some were non-significant.

Site index of aspen on droughty sands was around 55 or less, on better sandy loams it was around 70, and on silt loams in the 75 to 80 range.

The chief modifying factors that affect the relation of site index to texture were:

1. Shallow water-tables within about 8 feet of the surface increased site index on sandy soils by 5 to 10 feet. Optimum water-table depth was at 4 to 6 feet.
2. Repeat burns reduce site index by about 10 feet over most of the range of soil texture.
3. Poor internal drainage and aeration reduced site index by 15 feet.
4. Site index of aspen on sandy soils was increased by about 10 feet when these were underlain by soils of substantially higher waterholding capacity.
5. Coarse gravel at about 2 feet below the surface of soils classed as loams or sandy loams reduced site index 20 feet.

Chemical test of soils from good, medium, and poor sites revealed that the chief difference was a markedly higher content of calcium and magnesium, and to some extent potassium in the good sites. A hypothesis is advanced that the comparatively higher content of these nutrients is the primary cause of aspen's greater longevity and growth rate, and lower incidence of heart rot in aspen on the gray-wooded soils of northern Minnesota in contrast to the usually lime-poor drifts in northern Wisconsin. In Minnesota the mean annual increment in cubic feet per acre at culmination of mean annual growth at around age 50 was 80 cubic feet, while in the Wisconsin plots it was only 50.

Aspen is an important species for improvement of soils burned over by forest fires. Its annual litter fall ranges from 1900 to 3200 pounds per acre. Organic layers of aspen stands were high in available nutrients especially where substrates were calcareous.

Rooting depth of aspen ranged generally from 39 to 60 inches, with a maximum of 85 inches.

A close relation was found in nutrient content of soils and their silt-plus-clay content.

225 pages. \$2.95. Mic 57-2291

AN APPRAISAL OF AGRICULTURAL PROBLEMS AND POLICIES IN THE PHILIPPINES

(Publication No. 19,437)

Nathaniel Bautista Tablante, Ph.D.
Purdue University, 1956

Major Professor: J. Carroll Bottum

This report is divided into two main parts. Part I describes the existing situation and points out the major socio-economic problems associated with Philippine agriculture, with the use of background information gathered from secondary sources. Part II comprises an evaluation of agricultural policies, the setting up of general objectives of policy, a consideration of long-range alternative program-measures designed to attain the ultimate goal, and

the presentation of suggested lines of action which may be carried out in the immediate future to start with.

Agriculture is a fundamental segment of the national economy of the Philippines, considering the large proportion of the total population dependent upon the industry for their livelihood and its contribution to the national income and to the country's foreign trade. While this is so, many problems continue to remain unsolved, thereby retarding the economic development of the country and providing little opportunity for the people to enjoy a high standard of living.

The rapid growth of population continues to bear heavily on the existing resources of the Philippines and production has hardly kept pace with the levels of consumption of an increasing number of people. Agricultural productivity is still at a relatively low level, being the result of the play of numerous closely inter-related forces. The most important of these factors which tend to bring about low agricultural output per person are the use of unscientific farming practices and methods of production, low yields of crops and rates of livestock production, small size of farms, high labor requirements in many farm operations, low available capital per farmer and difficulty of securing productive credit at reasonable terms, unfair tenure arrangements and tenancy practices, and lack of economic opportunities outside of agriculture.

In addition to problems of agricultural production, here also are those problems relating to land use and development, agricultural finance, marketing and foreign trade, and the development of human resources and the improvement of rural living, to mention a few broad categories. The classification, survey and subdivision of lands, the issuance of valid titles to land, and the proper enforcement of laws relating to tenancy have not been effectively carried out, thereby slowing down considerably the program of land settlement and land tenure reform of the government. Credit from established lending institutions is often beyond the reach of small farmers, so that a large proportion of agricultural credit transactions are handled by landlords, merchants and private moneylenders who frequently indulge in unscrupulous practices to the great disadvantage of the farmer-borrowers. There is a lack of an orderly and efficient marketing system; marketing facilities are not adequate and essential marketing services are lacking or are performed inefficiently. As a result many producers do not possess much control over the marketing of their products. With respect to foreign trade, the problems include unfavorable balance of trade, lack of diversification in terms of both products and markets, and changes in commercial and economic relations between the Philippines and other nations. Community facilities and essential services for improved rural living, such as health, education, recreation, public utilities, and means of transportation and communication, are very inadequate in rural areas.

All of these conditions tend to bring about the present low economic status of the farm population of the Philippines. The problems are so closely inter-related to each other that priorities are difficult to assign. This implies that the problems should be approached simultaneously with measures that would be consistent with the general objectives of agricultural policy for the Philippines. These objectives include stability of agricultural incomes and comparability with other groups in society of similar ability, conservation and development of resources, economic

progress and efficiency, adequate supplies of food and fiber for the nation's population, maintenance of the family farm, and consistency with the overall policy of the nation and administrative feasibility—all of which move toward the attainment of the master goals of maximizing the social product over time, optimizing the distribution of income, and maintaining responsible freedom of individual action, in a democratic society.

The core of the problem, therefore, revolves around the question of what basic steps the Philippine Government should take during the next two or three decades for promoting the best economic interests of the nation and ultimately improving the standard of living of the people. The basic agricultural policies proposed to be carried out to accomplish this objective focus on the long-range adjustments considered necessary and desirable to increase efficiency in agricultural production, to develop an efficient and orderly marketing system for farm products, to improve rural living and to expand nonfarm economic opportunities.

Recognizing that the proper implementation of these policies would require huge appropriations and that the budget of the country has only a limited program-carrying capacity, it is recommended that a starting budget of from 50 million pesos to 60 million pesos in addition to the regular amounts in the national budget be made available. This initial amount would be distributed over a five-year period to start the implementation of the recommended measures. As many of the proposed projects as these funds would allow should be undertaken. Since the recommended courses of action will result in increasing the overall productivity of the nation, more funds would then be available and more projects could be undertaken without necessarily taking a bigger cut of the national budget.

Specifically, the recommendations made concern the improvement and expansion of agricultural research and extension, the improvement of land tenure and settlement, the improvement of agricultural credit, the improvement of marketing and trade, the improvement of general and vocational education, the expansion of nonfarm employment opportunities, and the provision of rural community facilities and services. While all the problems cannot be solved within a short period of time, it would be a wise investment for the Philippine Government to initiate as many of the proposed measures as the limited funds would allow. This will move eventually toward the accomplishment of the objective of securing greater productivity and higher standards of living for the Philippines.

356 pages. \$4.55. Mic 57-2292

CHARACTERISTICS OF A TOPOSEQUENCE OF SOILS, THE CARIBOU CATENA, IN THE PODZOL REGION OF EASTERN CANADA

(Publication No. 21,397)

Reuben Edward Wicklund, Ph.D.
Michigan State University, 1955

Investigations of Podzol development in the regions of Eastern Canada reveal that those soils possess profile characteristics that differ in many respects from Podzol soils reported elsewhere. This study presents the physical

and chemical characteristics of soils occurring on a given slope and evaluates the factor of topography in their development.

Four soil profiles were selected to represent the variations in this toposequence. Core samples were taken of the various horizons in the several profiles from which was obtained data on percolation rates and bulk densities. Bulk samples of each horizon were used for other physical and chemical analyses.

The A₀ horizon was present in all profiles and increased markedly in thickness with decreasing slope. The A₂ horizon that occurred in the well drained positions was replaced at the base of the slope by an A₁ horizon. The overall depth of profiles decreased with decreasing percent of slope.

In order to estimate net gains and losses within the profiles a modification of the resistant mineral method used by Marshall and Haseman was applied. This study used total silica, instead of zircon as the resistant reference mineral.

Results showed that there had been a net gain in weight in the sola of all profiles and that the A₂ was the only horizon having a net loss of materials in these soils. Large volume changes had occurred in the A₀, A₁, and B₂₁ horizons as a result of frost action, organic activity, and organic matter addition. Even the A₂, B₂₂, B₃, and G horizons had increased considerably in volume.

Marked increases in silt had occurred in all horizons of all profiles, whereas net losses in clay had taken place in all the horizons of the zonal soils. The soil in the poorly drained position showed a net gain in clay.

All the profiles were acid in reaction. The acidity decreased from the surface of the soil to the parent material and decreased with decreasing slope.

The profiles showed marked gains in organic matter content particularly in the A₀, A₁ and B horizons. Increases had occurred in all horizons of all profiles except the A₂ of the best drained soil. Aluminum had accumulated in all horizons except the A₂ and was distributed relatively evenly throughout the profile. All the zonal soils showed a small net gain in iron but without having any definite horizon of accumulation.

The exchangeable cations calcium, magnesium, and potassium, were largely concentrated in the surface horizons. The predominant cation was calcium. The exchangeable base status of the soil increased from the crest to the toe of the slope.

136 pages. \$2.00. Mic 57-2293

AGRICULTURE, ANIMAL CULTURE

CARCASS EVALUATION IN THE LIVE HOG

(Publication No. 21,101)

Charles John Heidenreich, Ph.D.
University of Missouri, 1957

Supervisor: Dr. John F. Lasley

Live-hog descriptive scores, body measurements, backfat probes, and carcass data were studied on 199

crossbred hogs of Landrace X Poland China X Duroc and Landrace X Poland China breeding farrowed in 1953 and 1954.

The influence of breed-cross, season, and sex on the above measures was studied by means of statistical techniques modified to fit these particular data. Environmental factors were shown to influence growth and development in the hog as well as genetic determiners.

Absolute live-hog measurements and backfat probes were of greater value than subjective scores in explaining variance in measures of carcass yields and were therefore used in multiple correlation studies. When three backfat probes (taken in the region of the fifth thoracic, fourth lumbar, and second sacral vertebrae) and three body measurements (body length, heart girth, and flank circumference) were combined into one correlation study, a value of multiple correlation equal to .463 was obtained with adjusted loin equivalent in the Landrace X Poland X Duroc cross with values of .499 and .718 shown with percentage of five primal cuts and percentage of total fat, respectively. Coefficients of multiple correlation equal to .565, .561, and .814 were obtained between the six measurements and the adjusted loin equivalent, percentage of primal cuts, and percentage total fat, respectively, in the Landrace X Poland cross.

The recalculation of the multiple correlation coefficient using only the two most important independent variables (heart girth and hip probe with adjusted loin equivalent; heart girth and body length with primal cuts; and shoulder probe and heart girth with percentage of total fat in the Landrace X Poland X Duroc cross and ham probe and body length with adjusted loin equivalent; shoulder probe and body length with percentage of primal cuts; and shoulder probe and body length on percentage of fat in the Landrace X Poland cross) gave values of .456, .405, and .642 for adjusted loin equivalent, percentage primal cuts, and percentage total fat in the Landrace X Poland X Duroc cross, and .477, .499, and .705 for adjusted loin equivalent, percentage of primal cuts and percentage total fat in the Landrace X Poland cross. Estimating equations were derived for predictive purposes.

Growth rate in terms of average daily gain from birth to slaughter was correlated with the three measures of gross carcass merit used throughout this research, i.e., adjusted loin equivalent, percentage of primal cuts, and percentage of total fat. Each breed-cross, season, and sex was studied separately.

No conclusive statistically significant relationships were found, although obvious trends in sex differences were observable. For barrows of both breed-crosses, average daily gain was negatively correlated with the adjusted loin equivalent and percentage of primal cuts, while an opposite relationship was indicated between daily gain and percentage of fat. Correlations for gilts between rate of gain and adjusted loin equivalent and primal cuts were positive, while those between average daily gain and percentage of fat were negative.

The apparent low correlations existing between rate of gain and carcass yields are indicative of independent genetically controlled physiological bases of these two economically desirable traits, and make possible the assortment and recombination of genetic determiners for both characteristics into a single breeding group.

137 pages. \$2.00. Mic 57-2294

A STUDY OF THE EFFECTS OF SUPPLEMENTAL ENDOCRINES ON THE DEGREE OF FERTILITY IN THE MALE

(Publication No. 20,560)

Ignacio Valente Ortega, Ph.D.
University of Minnesota, 1956

Adviser: J. N. Cummings

From 1953 to 1955 the Department of Animal Husbandry of the University of Minnesota conducted several experiments in which thirty-five rams and two bulls were treated with one or a combination of two of the following substances: testosterone, methyl testosterone, estradiol, pregnenolone, stanolone, cortisone, premarin, follicle stimulating hormone, luteinizing hormone, and stilbestrol under one or two of the following methods of administration: intratesticular implantation, subcutaneous implantation, subcutaneous injection, intramuscular injection and oral administration in order to determine the effects of these substances on the degree of fertility in the male.

Intratesticular implantation of testosterone at doses varying from 225 to 375 milligrams improved the semen quality of rams. This increase in fertility was mainly due to an improvement in the types of motility. The histological observations made on these rams showed a pronounced stimulation on the seminiferous tubules and other genital tissue. These effects appeared to be more pronounced in rams of medium fertility. Those in rams of very low fertility were negligible, while those in rams of very high fertility appeared to be of maintenance alone. The effects on the bulls were less prominent than in the rams. In their case the libido was the only characteristic affected.

Injections of testosterone, either subcutaneously or intramuscularly, at doses varying from 25 to 50 milligrams three times a week, had a detrimental effect on the semen quality of rams within a period of three months. Within this period an almost complete azoospermia resulted. The pattern of response appeared to differ in the two treatments. The histological observations showed that the treatments affected the testis tissue differently.

Oral administration of methyl testosterone at doses varying from 25 to 50 milligrams per day, definitely improved sexual drive and semen quality in rams. The increase in fertility was due to an improvement in all the semen characteristics studied. Methyl testosterone given orally to the bulls, at doses varying from 25 to 200 milligrams per day, did not produce the same effects. In this case the sexual desire was the only characteristic affected. The addition of stilbestrol to one of the bulls did not alter the effects one way or the other.

Intratesticular implantation of follicle stimulating hormone had very little effect, if any, on the semen quality and sexual behavior of the ram. The histological results indicated a marked degeneration and necrosis near the implantation site and surrounding tissue.

When estradiol was implanted intratesticularly it was not absorbed in most cases. However, in one case in which absorption did take place, the semen quality of the ram was improved very significantly.

The subcutaneous implantation of estradiol in rams produced a complete loss of libido.

The intratesticular implantation of pregnenolone and

stanalone did not affect the semen quality or sexual behavior of the ram. Pregnenolone was not absorbed by the testis tissue.

Intratesticular implantation of premarin (estrone sulfate), cortisone (desoxycorticosterone acetate) and luteinizing hormone proved to be detrimental to the semen quality of the ram. The histological observations made on these treatments showed a considerable amount of damage to the testis. The seminiferous tubules were atrophied and were depleted of germinal tissue.

The intratesticular implantation per se had very little effect, if any, on the semen quality of rams and bulls.

122 pages. \$2.00. Mic 57-2295

**SOME FACTORS AFFECTING POLLEN COLLECTION
BY HONEYBEES AND POLLEN AS A LIMITING
FACTOR IN BROOD REARING AND
HONEY PRODUCTION**

(Publication No. 21,760)

Salah El-Din Rashad, Ph.D.
Kansas State College, 1957

Pollen is an important source of proteins, minerals, enzymes and vitamins in the honeybee diet and important factor in brood rearing. Proper knowledge of the pollen cycle, periods of abundance and dearth and factors that affect the activity of the honeybee in pollen collection are important for successful beekeeping management.

In Part I the study was undertaken to find the important pollen sources of the area, seasonal trend and pollen cycle during successive years; and some important factors affecting the activity of the honeybee in pollen collection.

Trapping of bee collected pollen was from March through October during the years 1954, 1955 and 1956. In 1954 the trapped pollen was weighed daily and a representative sample was sorted according to colors. Each type of pollen was examined microscopically for identification. Forty nine plants were used as pollen sources, 30 of which were identified.

An electrical machine was constructed for periodical pollen collection. The quantity trapped at any two hour period was weighed and correlated with weather factors.

During early spring temperature was the most important factor governing the activity of the honeybee in pollen collection. Pollen was collected at temperatures as low as 46-52°F. Above 95°F. pollen collection was reduced. Rainfall stopped the activity completely. There was no observable effect of wind velocity at 11 m.p.h. or below. Above 11 m.p.h. the activity slackened, at 21 m.p.h. flight ceased. Wind velocity of 13-19 m.p.h. accompanied by low temperature of 46-48°F. stopped the activity.

There was a positive and significant correlation between the quantities of pollen collected and the period of the day. Temperature did not appear to have any great influence during the period from April through June because of the lack of temperature extremes. Minimum and mean relative humidity gave a negative and significant correlation with quantities of pollen collected. The number of pollen sources gave a negative and significant correlation with the quantities of pollen collected.

There was a similar seasonal trend of the incoming

pollen during the three years. During these three years there was a period of pollen deficiency which extended from the latter part of June until the early part of July.

Part II. was a study of the effect of the incoming pollen on the brood rearing cycle; the effect of the use of pollen traps in the economy of the colonies either in brood rearing or honey production; the stimuli caused by the pollen traps and the quantity of fresh pollen; and the number of cells of packed pollen required for rearing one bee.

Sealed brood measurements were made at 12 day intervals with six colonies, two of them being equipped with pollen traps. The pollen trapped was weighed daily. This procedure was followed from April through October during the years 1954, 1955 and 1956.

Sealed brood counts showed that the area is characterized by having two peaks in brood rearing; the first one, the larger, occurs during the early part of June; the second and smaller occurs during the early part of August.

The use of the pollen traps caused a decrease in the amount of brood reared and honey production which averaged for the three years 15.25 and 41.4 percent respectively per colony.

It was estimated that 0.0665 gram of fresh pollen was needed for rearing one bee and that one cell of packed pollen will be sufficient for rearing 1.2 bees.

The efficiency of the trap was 53 percent and it caused an increase in pollen collection which amounted to 81.5 percent.

94 pages. \$2.00. Mic 57-2296

AGRICULTURE, PLANT CULTURE

**THE EFFECT OF EQUAL LETHAL HEAT
TREATMENTS AT VARIOUS TIMES AND
TEMPERATURES UPON SELECTED
FOOD CONSTITUENTS**

(Publication No. 21,266)

Gale Richard Ammerman, Ph.D.
Purdue University, 1957

Major Professor: Norman W. Desrosier

Food products such as milk and tomato juice have been preserved by both the high temperature short time (HTST) and the low temperature long time (LTLT) methods. Process times have been based primarily on the inactivation of bacterial spores and enzymes. It was postulated that heat treatments at various temperatures which were calculated as equivalent in terms of spore inactivation probably would not be equivalent processes in terms of other characteristics of foods. This investigation was devised to study the effects of equivalent lethal heat processes at various temperatures on the color, vitamin and flavor retention, and selected characteristics of protein solutions.

In order to subject the experimental materials to equivalent heat processes at the selected temperature range of 215°F. through 265°F. a heat exchanger (Thermosporometer) was constructed and evaluated.

A laboratory heat exchanger was also designed for processing food products at temperatures below 212°F..

HTST processes in the range of 215°F. through 250°F. resulted in less change in the color of beet, cherry, grape and tomato juice processed in the Thermosporometer. However, when beets were diced, canned and processed in the retort, the juice from the samples processed at the extreme temperatures of 230°F. and 265°F. were nearly identical to each other and less severely altered than those processed at intermediate temperatures of 240°F., 250°F., and 260°F..

The effect of equal lethal heat treatments on the average retention of riboflavin in whole kernel sweet corn, pureed sweet corn and tomato juice was determined. The average retention of riboflavin in whole kernel sweet corn canned and exposed to sterilizing processes in the retort was 91 percent. There was no significant difference due to equivalent processes at different temperatures. When pureed sweet corn was exposed to equivalent lethal heat treatments in the Thermosporometer, the higher temperatures between 220°F. and 250°F. resulted in a larger percent retention of riboflavin. HTST processes also resulted in retention of higher percentages of the riboflavin, ascorbic acid and thiamine in tomato juice.

Infrared spectrophotometer curves for clove and cinnamon solutions exposed to equivalent lethal heat treatments at 220°F. and 250°F. and an unheated sample were analysed. The data indicated that the chemical groups reported in literature to be important from the flavor standpoint were present in equal amounts regardless of whether the solution had been heat processed or not. The curves for the unheated material and the samples exposed to calculated equivalent heat processes at 220°F. and 250°F. were identical.

There was no detectable difference in the odor intensity of a cinnamon solution due to exposure to equivalent lethal heat treatments between 220°F. and 250°F.. The lower temperatures resulted in a more severe color change as measured by optical density at 625 mu. There was apparently no relationship between color changes and the flavor of the cinnamon solution.

The effect of heat processing on a protein solution was also evaluated. There was a significant reduction in the rate of trypsin activity on heated casein compared to unheated when the "F" value was four, regardless of the processing temperature. However, there was no significant difference between the various treatments when the samples were exposed to processes calculated to be of equal lethal values. Increasing the "F" value from one to four resulted in little change in the availability of casein to trypsin. The relative viscosity of casein solutions was the same for the various temperatures when the processes were of equivalent lethal value. Increasing the "F" value from one to three and finally to ten resulted in an increase in relative viscosity for all equal heat treatments regardless of temperature. However, there was apparently no difference in the relative viscosity due to equivalent heat processes at the various temperatures between 220°F. and 250°F.. Heat treatment resulted in a marked increase in free sulphydryl groups in an egg albumen solution. However, there was apparently no difference in the sulphydryl group content due to exposure to equal lethal values at temperatures between 220°F. and 250°F..

145 pages. \$2.00. Mic 57-2297

ECOLOGICAL FACTORS IN RELATIONSHIP TO THE
DETERIORATION OF PEACH PLANTINGS AS
EVIDENCED BY A STUDY IN OTTAWA COUNTY, OHIO

(Publication No. 21,467)

Carl Spencer Bittner, Ph.D.
The Ohio State University, 1957

The peach industry of Ottawa County, Ohio, deteriorated from a total of 1,230,966 trees in 1900 to 153,154 trees in 1954. The moderating climatic influence of Lake Erie stimulated the early interest in peach growing. In this study unfavorable ecological factors were largely credited with influencing the deterioration of peach planting in the area. To properly evaluate the reasons for the decline, a critical study of the Peninsula, Miller, Balduf, and Kalb peach orchards was initiated. These orchards were considered typical of the county, and for purposes of this study were rated as first, second, third, and fourth, respectively, in the order of their vigor. Nine detailed evaluation factors were compared to determine which contributed to good peach tree performance and which did not. These factors were (1) original tree vegetation as an index of site desirability, (2) soil classification according to type and soil test, (3) capillary and noncapillary soil porosity, (4) water levels, (5) water movement in soil, (6) root distribution and soil mass, (7) leaf size, (8) shoot size, and (9) length of tree life.

It was found that the Peninsula and Miller orchards were planted on well-drained soils which originally supported red oak, white oak, bur oak, black walnut, and shagbark hickory forest trees. The Balduf and Kalb sites, both of which were poorly drained, originally supported elm, pin oak, black ash, swamp white oak, and shagbark hickory.

The Peninsula orchard soil was classified as Lucas loam, the Miller as Fulton silt loam, the Balduf as Toledo silty clay, and the Kalb as Fulton silt loam-heavy phase. Soil tests revealed no extremes which could be correlated with differences in tree vigor. The Peninsula soil had the greatest noncapillary porosity, and was followed in order by the Miller, Balduf, and Kalb.

Measurement of water levels in tile wells, made over a 20-month period, revealed that the water usually rose highest in the Kalb orchard and that the water movement outward was slowest and remained at higher levels than in the other orchards.

Roots were most widely distributed in the Peninsula orchard soil, Miller, Kalb, and Balduf following in descending order. Root weights revealed almost a reverse sequence, Kalb being high, and Balduf, Miller, and Peninsula, following in descending order.

Leaf area and length measurements revealed that the Peninsula leaves were greatest, Miller, Balduf, and Kalb following in the order given. Leaf width, thickness, and midrib and petiole measurements, however, revealed that the Peninsula shoots were significantly longer and thicker, the Kalb shorter and thinner, and the Miller and Balduf between these extremes.

Longevity and survival studies showed that the Peninsula orchard survived for 30 years, the Miller and Balduf for 22 years, and the Kalb for 21 years. No single item was the determining factor which governed the growth, vigor, and longevity of the four orchards which were chosen as being representative of Ottawa County peach orchards.

Site was found to be an important ecological factor in

peach-growing in the county. The choice of a site that originally supported forest trees that approached the beech-maple climax contributed to successful peach-growing, as did also the selection of a soil site that exhibited great noncapillary porosity and provided adequate water movement to insure peach-tree longevity. Factors evaluated which were inconclusive or negative included soil tests, water levels, and root mass.

Aside from the advantages of favorable climate, the area lacks many of the desirable qualities deemed essential to good peach production. Only the very best sites should be planted and the very best cultural care provided if the industry is to survive in Ottawa County, Ohio.

142 pages. \$2.00. Mic 57-2298

CHEMICAL WEATHERING AND DEPOSITIONAL FACTORS IN THE ORIGIN OF MINERALS IN SOME NORTH CENTRAL WISCONSIN SOILS

(Publication No. 20,620)

Bruce Elliot Brown, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Marion L. Jackson

An investigation of mineral contents of four northern and central Wisconsin soils was carried out to determine sources of the soil materials and to study chemical weathering changes in the soils. Petrographic counting techniques were used in determining mineral contents of sand and silt fractions. Minerals less than 5u were identified by x-ray diffraction methods and their quantitative estimation was aided by elemental, ignition loss, cation exchange capacity, and glycerol sorption analyses. The results of this research are summarized as follows.

First, heavy and light mineral analyses of the Hiawatha sand fractions indicate uniform (monogenetic) sand deposition. Two to four times as much silt is found above the fifteen inch level as occurs below it indicating admixture of silt to the surface. The heavy and light mineral distribution shows that over 95% of the sandy drift from which the soils are formed comes from the Bayfield sandstones with less than 5% coming from other Keweenawan sandstones and lava flows. Minerals are more weathered in the A₂ horizons than through the B and C horizons. This is shown (a) by the destruction of pyroxene and hornblende in the A₂ horizons, (b) by quartz accumulation in the A₂ horizons in fractions 5-0.2u attributable to the resistance of quartz to weathering in this size range especially where cheluviation is active, and (c) by formation of a well crystallized, high charge, dioctahedral montmorillonite in the A₂ horizons from a vermiculite-chlorite interstratification like that present in the upper B horizons. In the 2-0.2u fraction of the Hiawatha loamy sand, the montmorillonite content goes from undetected in the B₂ to 33% in the A₂ horizon while the interstratified vermiculite-chlorite goes from 32% in the B₂ to less than 5% in the A₂ horizon. The vermiculite-chlorite interstratification, the dominant layer silicate in all horizons but the A₂, appeared to be a dioctahedral type, probably derived from the weathering of muscovite.

Second, the loess cap in which the A and B horizons of

the Meade silt loam are developed is similar to most loess of the area. It is not developed from the till of the D horizon. The bedrock source of the vermiculitic D horizon was a biotite rich amphibolite as indicated by the presence of oligoclase, biotite, quartz, hornblende, epidote, and sphene as the main mineral species of the heavy and light fractions of the sand fractions of the D horizon. The occurrence of a 12.1A peak in the + 250u fraction attributable to the 10-14A interstratification of biotite and vermiculite is shifted to a 14A peak in the 20-5u fractions, illustrating the weathering change, biotite \rightarrow vermiculite. In the clay fractions, the trioctahedral species disappeared with increasing fineness in horizons which were rich in trioctahedral minerals in coarser fractions, indicating either that trioctahedral types are less resistant to weathering in the fine fractions so that only dioctahedral types accumulate or that dioctahedral types have been added to the fine fractions in quantity enough to submerge the diffraction of the trioctahedral types.

Third, the analysis of the Myron D horizon and its parent granite indicate a sequence of weathering of chlorite to vermiculite by way of a chlorite-vermiculite interstratification. The replacement of dioctahedral for trioctahedral layer silicates in the finer fractions was noted in this soil also.

The overall data show the increased intensity of chemical weathering with proximity to the soil surface and with finer particle size and also illustrate the largely local origin of glacial drift and uniformity of loess over large areas of dissimilar bedrock.

189 pages. \$2.50. Mic 57-2299

A CONSIDERATION OF MECHANISMS OF PHOSPHATE FIXATION AND THE CHARACTERIZATION OF PHOSPHATE-FIXING CAPACITY OF SOILS

(Publication No. 21,469)

Jefferson Lee Flowers, Ph.D.
The Ohio State University, 1957

Preliminary studies with true solutions indicated that certain reagents might block phosphate precipitation by Ca^{++} , Al^{+++} and Fe^{+++} , thus permitting the characterization of phosphorus-fixing capacities of soils. In similar studies with Mahoning silt loam soil, these reagents failed to quantitatively characterize phosphate fixation. This failure may have been due to the lack of a reagent specific for the precipitation of aluminum. The results obtained were qualitatively similar to those with solutions, suggesting a solution precipitation mechanism of phosphate fixation. The data also suggested that aluminum may be the most important phosphorus-precipitating cation in these soils.

In electrodialized soils (Hoyleville silty clay, Clermont silt loam, Crosby silt loam, Canfield silt loam, Brookston silty clay loam, Mahoning silt loam, Wooster silt loam, Tilsit silt loam) saturated to different levels with Ca^{++} and/or K^+ , potassium increased water solubility of native soil phosphates and decreased phosphate fixation; calcium had no effect on water solubility of native soil phosphates but increased phosphorus fixation. The results suggested that as basic cations are removed in electrodialysis,

phosphorus may combine with aluminum and be retained in the soil. Potassium added to such systems would favor the formation of more soluble phosphate combinations. These findings suggest that Ca/K ratios and their activities in soils may have an important relation to availability of native phosphates and of phosphates fixed from added fertilizers.

Ammonium acetate extracts (pH 4.8) of surface and subsurface soils (Mahoning silt loam, Ashtabula silty clay loam) incubated at saturation and field capacity, which were found in a separate investigation to vary widely in iron and aluminum, were analyzed for phosphorus. A positive correlation was found between extractable aluminum and phosphorus; however, no such relation could be established for iron and phosphorus. Extracts of surface soils incubated at saturation which contained large quantities of iron also contained appreciable quantities of phosphorus. This suggested that iron may have been complexed by the products of anaerobic decomposition of organic matter and thus was incapable of forming molecular combinations with phosphorus.

Mild dehydration of freshly precipitated iron and aluminum hydroxide by treatments with n-amyl alcohol, sufficient to reduce solubility without replacement of OH^- groups, caused the reduction of phosphate fixation by both hydroxides. This was taken as evidence that hydrous oxides in soils may fix phosphorus by a solution-precipitation mechanism involving solubility product principles and ionic activities. The effect of dehydration on phosphate fixation was more temporary for aluminum than for iron, indicating the more rapid rehydration of aluminum than iron when incubated in weak NaH_2PO_4 solution. Soils (Til-sit silt loam, Canfield silt loam, Mahoning silt loam, Miami silt loam, Brookston silty clay loam, Hoytville silty clay) treated in a similar manner and incubated three weeks fixed considerable phosphate but show no effect of dehydration. This may be evidence that aluminum is more important than iron in the fixation of phosphorus by the hydrous oxides in these soils. 137 pages. \$2.00. Mic 57-2300

A NUTRITION STUDY OF CORN AND GRAIN SORGHUM BY MEANS OF FOLIAR ANALYSES

(Publication No. 21,755)

Glenn Walter Hardy, Ph.D.
Kansas State College, 1957

The objectives of this investigation were (1) to investigate the effect of addition of certain nutrient elements to the soil upon leaf concentrations of these and other elements, (2) to establish, if possible, critical lower limits of nitrogen, phosphorus and potassium in leaves of corn and grain sorghum, and (3) to ascertain whether or not soil deficiencies of various nutrient elements could be detected by leaf analyses.

Leaf samples of corn and grain sorghum were taken from established fertilizer trials during the growing seasons of 1953, 1954, and 1955. Individual leaf samples consisted of composites of third basal leaves chosen at random from the two center rows of each plot sampled.

Samples were subjected to chemical analyses for nitrogen, phosphorus, potassium, calcium, and magnesium.

Analytical data are reported in percent of air dry weight of the leaves. Thirteen trials with each crop are represented in this report.

It was difficult to increase leaf nitrogen concentration of corn when nitrogen content of corn leaves was as high as 2.38 percent in unfertilized corn. It was relatively easy to raise leaf nitrogen content of milo to $2.70 \pm .10$ percent.

Additions of either or both of phosphorus and potassium without inclusion of nitrogen had a tendency to reduce leaf concentrations of nitrogen. This may have been due to a dilution caused by added vegetative growth or it may have been due to induced anionic competition. There was definite tendency for leaf concentration of phosphorus in grain sorghum to increase as leaf nitrogen level increased. This was not observed with corn.

Addition of potash to soil which had low potassium availability brought about marked increases in leaf potassium concentration of corn. The effect of added potash was erratic with both crops when soils of high potassium availability were considered.

Corn leaf magnesium concentration was depressed by addition of potash to soil. Application of sulfate of potash-magnesia did not alter corn leaf concentration of magnesium.

A critical lower limit of leaf nitrogen concentration was indicated for grain sorghum. This value was $2.70 \pm .10$ percent. There was some evidence that the value for corn was below 2.38 percent.

Data were insufficient for definite establishment of a critical lower limit for leaf phosphorus concentration. Nevertheless, high yields of corn were produced where leaf concentration ranged from 0.26 to 0.29 percent. The best yields of grain sorghum were produced with a phosphorus concentration ranging from .33 to .48 percent.

No establishment of a critical lower level of potassium was made for either crop.

Indication was provided that leaf analyses were useful in the detection of soil deficiencies of both nitrogen and potassium. Low potassium soils invariably produced leaves which were low in potassium concentration. Available nitrogen deficiency was accurately indicated for each crop.

Some indication was obtained which suggested that high magnesium concentration in leaves of corn might be associated with soil deficiencies of potassium. It also appeared that potassium-magnesium ratios in corn plants might be indicative of the status of soil potassium.

82 pages. \$2.00. Mic 57-2301

THE NITROGENOUS CONSTITUENTS OF THE FLOWERS, FRUITS, ADJACENT LEAVES, AND STEMS OF DELICIOUS AND GOLDEN DELICIOUS APPLES, AND THEIR RELATION TO FRUIT SETTING

(Publication No. 21,438)

Richard Amherst Hayden, Ph.D.
The Ohio State University, 1956

Apple varieties differ considerably in the percentage of flowers which develop into fruits. The variety Delicious usually has a very low percentage set, while at the other extreme is Golden Delicious, with a very high percentage of flowers developing into fruits.

In order to gain some insight into the causes of this difference, a program of research was established embracing the cytological, physiological, and chemical aspects of the problem. This study, then, comprises the chemical phase of the problem, and was designed to give information concerning the relationships between the nitrogenous constituents of the flower cluster and the fruit setting characteristics of the two varieties, Delicious and Golden Delicious.

Since fruit development is the climax of the flowering process, it was decided to study the changes in nitrogenous constituents during the entire flowering period and until the fruits became discernible from the abscising flowers. Competition for nutrients between the flowers on the cluster was thought to be one of the major factors in fruit setting. Therefore, at the pink stage, sufficient clusters for later sampling were deflorated, some to the terminal flower and some to the two lateral flowers having the largest subtending leaves, in an attempt to reduce this competition. Samples of undeflorated clusters were then taken at the pink, balloon, full bloom, petal fall, and first drop stages, and on July 8, after active development had ceased. Samples of deflorated clusters were taken at the full bloom, petal fall, and first drop stages. The clusters were dissected to the cluster base leaves, cluster base, vegetative shoot, and terminal, lateral, and "other" lateral flowers; preserved by lyophilization; and analyzed for total nitrogen, amino nitrogen, amide nitrogen, and hydrolysis-resistant nitrogen. This last fraction was developed for the purpose of obtaining a better indication of the immobile nitrogen laid down within the tissues.

The percentage and absolute amounts of the nitrogenous constituents in the various structures at the various sampling times are presented for both Delicious and Golden Delicious. The flower clusters of these two varieties were notably similar in nitrogenous composition with a few exceptions, which, however, were deemed of considerable importance. Some factor other than competition among the flowers appeared to be the primary factor affecting fruit setting and the varietal difference in this respect. Furthermore, the results indicated that competition for nutrients was not serious among the flowers of either variety. Previous work indicating that the cluster base depended upon the presence of flowers and developing fruits for maximum growth and development was substantiated and enlarged upon.

The period from full bloom to the first drop stage received particular attention since it was considered to be the most critical period in fruit setting (that period during and just following fertilization of the ovule).

In Delicious flowers the amino nitrogen was high at petal fall and low at the first drop stage, while in Golden Delicious the reverse occurred. These variations were considered to be connected with fruit setting through their relation to the protein metabolism of the flowers. Furthermore, the amino nitrogen content of Delicious flowers after petal fall may have been sufficiently low to reduce fruit setting. Translocation and reutilization within the cluster of nitrogenous constituents from abscising flowers was much greater in Golden Delicious than in Delicious, indicating further the better nutritional conditions existing in Golden Delicious clusters.

As a result of this chemical study, it was concluded that cytological and physiological conditions are more

directly related to fruit setting than the nitrogenous constituents. 203 pages. \$2.65. Mic 57-2302

AMMONIUM AND POTASSIUM FIXATION AND RELEASE IN SOILS

(Publication No. 21,528)

Joseph Ogden Legg, Ph.D.
University of Maryland, 1957

Supervisor: Dr. John H. Axley

The ammonium fixation capacities of several horizons of 19 soil profiles, representing 9 soil series, were determined by the KCl leaching method. Fixation capacities ranged from less than 0.5 to more than 15 me./100g. and generally increased with depth of the soil horizon.

A Myersville soil profile was found to have outstanding fixation properties. Fixation was lowest in the A horizon and highest in the B₂ and C horizons. As an average of all horizons, fixation values were 6.44, 7.37, and 9.72 me./100 g. for moist, air-dry, and oven-dry fixation conditions, respectively. A maximum fixation value of 15.93 me./100 g. was obtained with the B₂ horizon under oven-dry conditions. Vermiculite was considered to be responsible for the high fixation capacity of this soil.

The ammonium fixation capacities of 4 cultivated Myersville soils averaged 4.85 me./100 g. for the surface soils and 7.16 me. for the corresponding subsoils. The former value is similar to that obtained with a nearby virgin B₁ horizon.

Nitrification of ammonium added at the rate of 100 p.p.m. of nitrogen to a virgin Myersville soil ranged from 46 percent in the A horizon to 9.6 percent in the C horizon during a 50-day incubation period. Average nitrification values for 2 Myersville cultivated soils were 59.1 percent for the surface soil and 30.0 percent for the subsoil. In comparison, 99.4 percent of the added ammonium was nitrified in a Hagerstown surface soil under similar conditions.

In a greenhouse test the yield of oats grown on a Myersville B horizon was significantly lower with an ammonium source of nitrogen than with a nitrate source. The addition of 1000 p.p.m. of potassium had no effect on yields when applied in combination with NaNO₃, but decreased yields when applied with (NH₄)₂SO₄.

The ammonium fixation capacity of a Pachappa subsoil, previously incubated with 1, 2, 5, or 10 percent alfalfa for 6, 12, or 24 months, decreased with increasing alfalfa additions. For example, the original fixation capacity of 4.35 me./100 g. was decreased to 0.40 me. by the 5 percent addition during 6 months incubation. Maximum decreases in fixation capacity generally took place within the shortest incubation period. Determinations of fixed potassium in samples receiving 10 percent alfalfa indicated that a decrease in fixation capacity of only 0.6 me./100 g. could be accounted for from this source.

An investigation of a thermal method for the determination of fixed potassium in soils, proposed by Kolterman and Truog, failed to substantiate the assumptions upon which the method is based. Potassium released by the

thermal method from 5 soils previously used in prolonged greenhouse tests indicated a possible use of the method for obtaining a relative measure of the nonexchangeable content of soils. Single heating and extraction treatments released from 89 to 1350 p.p.m. of nonexchangeable potassium from a series of 25 Maryland soils; these values showed little relationship to the exchangeable potassium content of the soils. 127 pages. \$2.00. Mic 57-2303

THE RELATIONSHIP OF NONEXCHANGEABLE POTASSIUM RELEASE TO EXTRACTION pH AND MINERAL DECOMPOSITION

(Publication No. 21,306)

Curtis John Overdahl, Ph.D.
Purdue University, 1957

Major Professor: Dr. Stanley A. Barber

The relative rates of potassium release among soils, its relationship to soil clay, and its influence on availability of potassium to the plant were investigated. Extractions were made on these soils using cation exchange resins, acid buffered solutions, boiling water, and varying concentrations of HCl.

When cation exchange resins and soil were mixed in water for various periods of time to induce release of the nonexchangeable potassium; sodium resins gave no release; hydrogen resins gave large increases in neutral and acid soils but little from calcareous soils. The calcareous soils, however, yielded large quantities of nonexchangeable potassium to plants. It thus appeared that the pH during incubation of the high lime soils should be lowered to values approximating that of soils neutral or acid in pH.

Buffered acid solutions were used to release nonexchangeable potassium in an attempt to control the pH of the soil at a uniform level. The exchangeable potassium was removed before release of nonexchangeable potassium was investigated. Release rates for seven soils were then obtained by observations on random samples over a period of 48 days which demonstrated relative differences in nonexchangeable potassium release. The equilibrium level was approached at approximately the same rate for all soils. The differences in rate of release therefore appeared to depend on the magnitude of the nonexchangeable potassium present rather than on a difference in rate at which an equilibrium was reestablished.

The effect of soil pH on potassium release and mineral decomposition during extraction was investigated. Large quantities of nonexchangeable potassium were released at low pH levels and these quantities appeared to be related to plant uptake for prolonged periods of cropping. Exchangeable potassium measurements for high release soils were greatly increased when the acid concentration of the extracting reagent was increased. For the low release soil, however, the exchangeable potassium measurements increased very little with increase in acid concentration. Mineral breakdown as measured by exchange capacity differences occurred in the strong acid range during a 12 day storage period on two of the three soils studied. X-ray analysis on these soils showed changes in mineral composition after a similar acid storage period. No mineral

decomposition was observed for strong acid extractions when potassium measurements were made immediately following the acid contact with the soil. Potassium release and hydrogen ion concentration do not show a linear relationship except when stored at pH values of less than or more than 2. At approximately pH 2 there is a definite change in the quantity of potassium released relative to the hydrogen ion concentration. It was below this pH value where mineral breakdown was apparent.

Multiple regression analysis showed that the predicting ability of the exchangeable potassium measurements can be significantly improved when used in combination with nonexchangeable potassium values. The effect of the nonexchangeable measurement may improve the predicting ability even further under conditions of exhaustive cropping.

Little or no nonexchangeable potassium was released at room temperature by extracting solutions other than acids under the conditions studied. Soils boiled in water released very small amounts of nonexchangeable potassium, but these values did correlate with acid extractions.

These findings concerning the nature of nonexchangeable potassium release are useful in interpreting potassium fertilizer response by crops relative to values determined by chemical extraction. 113 pages. \$2.00. Mic 57-2304

PROTEIN AND CARBOHYDRATE RELATIONSHIPS IN WINTER WHEAT AS INFLUENCED BY MECHANICAL INJURY

(Publication No. 21,758)

Arland Walter Pauli, Ph.D.
Kansas State College, 1957

Pawnee winter wheat plants grown at Agronomy Farm, Manhattan, Kansas were injured mechanically at one of several stages before maturity from 1953 to 1956, inclusive, to determine causes for reduction in yields of injured plants. The study concerned (a) quantities of nitrogen accumulated in the portion of the plant above ground, (b) amounts of nitrogen and carbohydrates translocated to the developing grain, (c) protein percentage in harvested grain, and (d) acre production of crude protein and crude starch.

Three types of injuries were inflicted: (a) stems were lodged near the ground (lodged low), (b) stems were lodged between the flag leaf and head (lodged high), and (c) leaf blades were removed. Lodging injuries were inflicted by bending and pinching stems between the fingers to simulate natural lodging. Leaf blade removal consisted of pinching off all leaf blades, leaving the leaf sheaths intact.

Grain from plants injured within five-day intervals from five days before heading to maturity provided composite samples for various analyses. Crude protein was determined as (nitrogen x 5.7). Crude starch was determined indirectly as total dry weight per kernel minus combined weights of crude protein, ash, fat, and crude fiber. These data were compared with determinations on grain from uninjured plants in adjacent rows.

Smaller quantities of nitrogen were accumulated in injured plants and less nitrogen was translocated to the grain. Production of protein per acre was decreased when plants were injured.

Although decreased amount of protein contributed to decreases in acre yields of injured plants, the primary factor appeared to have been reductions in amounts of crude starch found in the grain.

Greater decreases in acre yields when leaf blades were removed at or just prior to heading were associated with loss of nitrogen which had accumulated in the leaves and with decreased photosynthetic tissue. Decreases in acre yields when leaf blades were removed later in the season were offset to the extent of protein and crude starch which had accumulated in the grain prior to the time of injury.

Greater decreases in yields caused by lodging two weeks after heading possibly were associated with hardening and lignification of stem tissues, resulting in restrictions on translocation when stems were lodged. Plants lodged earlier were apparently better able to recover when translocation was less restricted. Decreases in acre yields of plants lodged later in the season were offset to the extent of protein and crude starch which had accumulated in the grain before injuries were inflicted.

It was postulated that smaller quantities of water were taken into lodged plants, resulting in decreased rates of photosynthesis and decreased carbohydrate production. It was suggested that smaller amounts of crude starch found in grain of lodged plants resulted both from reduced amounts of carbohydrates produced in leaves, and from the effect of a high respiration rate on the greater proportion of sugars stored as compared with starch. Decreases in rates of photosynthesis may have caused reductions in amino acid synthesis and in decreased protein production.

Production of carbohydrates were decreased proportionately more than of protein when plants were lodged, resulting in a higher percentage of protein in the grain. Removal of leaf blades caused proportionately greater decreases in amounts of protein found in the grain compared with carbohydrates. Thus, when leaf blades were removed, increased ratios of carbohydrates to protein resulted in decreases in the percentage of protein in the grain.

52 pages. \$2.00. Mic 57-2305

MINERAL AND PROTEIN CONTENT OF WHEAT GRAIN AS INFLUENCED BY VARIETY, SOIL, AND FERTILIZER

(Publication No. 21,459)

Hari Govind Singh, Ph.D.
The Ohio State University, 1956

Varietal differences among wheats in their baking behavior are easily demonstrated, but it has been difficult to find any physical or chemical factors associated with the differences found. Possibly the ash elements, especially if incorporated in the protein molecule, exert notable effects. The purpose of the study was to find whether or not there were differences between varieties in the composition of the ash of whole wheat, and whether these differences were independent of fertilizer treatments and soil types.

Protein determinations and mineral analyses (nine elements) were made on four varieties of wheat, grown with eight fertilizer treatments at two locations in Ohio, in 1953. Varieties were Pawnee, a hard red winter wheat, Seneca and Butler, two soft red winter wheats, and Cornell

595, a white wheat. Fertilizers used were nitrogen, phosphorus, and potassium, each at a heavy rate, and in all combinations.

The soils were Canfield silt loam at Wooster, and Hoytville clay at Hoytville, Ohio. The design was a randomized complete block, with six replications at each location. Determinations were made on whole grain, which was ground on a small Wiley mill.

The elements studied were: phosphorus, potassium, calcium, magnesium, sodium, iron, manganese, copper, zinc, and silicon. Phosphorus was determined by the colorimetric method, the next four elements by flame photometer, and the remainder by spectrographic means. A satisfactory working curve for manganese was not obtained; hence quantitative estimates were not made for this element.

Location and fertilizer applications had marked effects on grain yield. At both locations, phosphorus had a greater effect on yield than either of the other elements. Grain yield and bushel weight were consistently higher at Hoytville than at Wooster.

When nitrogen was applied, there was a consistent increase in protein content at both locations. Total ash was different in different varieties, and varied with location and fertilizer treatments.

The phosphorus content of the grain varied among varieties and between locations. Potassium made up a higher percentage of all ashes than any other element. The grain from Hoytville was higher in potassium than that from Wooster.

Varieties differed in their calcium, magnesium, and sodium content. The grain from Wooster was higher in these elements than that from Hoytville.

Iron, copper, and zinc varied among varieties, between locations, and with fertilizer applications. The grain from Hoytville was higher in iron, copper, and zinc than that from Wooster.

Varieties differed in their silicon content. This element varied between locations.

Pawnee was significantly higher in calcium and lower in potassium than the other varieties, independently of location or fertilizer treatment. Likewise, Cornell 595 was higher in potassium and lower in iron and sodium than the other varieties. There is apparently no genetic control that rigidly limits the uptake of an element. Nevertheless, because variety is a clear and important factor in ash composition, genetic factors must be real and significant in exerting an influence on mineral uptake and distribution. It is suggested that these varietal differences in ash composition may be responsible in part for differences in baking behavior.

81 pages. \$2.00. Mic 57-2306

THE EFFECT OF CALCIUM-POTASSIUM RATIOS ON THE INCIDENCE OF POTATO SCAB

(Publication No. 21,392)

Philip Beaumont Turner, Ph.D.
Michigan State University, 1955

Three field trials were carried out to ascertain the effect of calcium-potassium ratios upon the scabiness and yield of potato tubers and the uptake of calcium and

potassium by the leaf. One field trial was conducted to determine whether application of zinc would reduce scabbing of potatoes. A greenhouse experiment was performed to test the effects of lime placement on yield and scabbing of tubers.

The field soil was Hillsdale sandy loam having originally a pH of 6.2 and an exchangeable calcium and potassium content of 3.50 and 0.80 milliequivalents per 100 grams, respectively. Katahdin, Chippewa, and Sebago potato varieties were grown.

For the greenhouse study Emmet fine sandy loam with a pH of 6.5 and five percent organic matter was chosen. Chippewa potatoes were used in this experiment.

In order to obtain descending calcium-potassium ratios, potash was supplied at rates of none to 450 pounds per acre in 50 pound increments. Zinc at the rates of none, 12.5, and 25 pounds per acre was superimposed on a potash treatment series.

Lime was applied in bands at the nine inch depth and was mixed throughout the top nine inches of soil which had previously been leached with sulfuric acid to create two pH levels.

At intervals throughout the growing season leaf samples were taken from the field plots and analyzed for total calcium and potassium, while soil samples taken were analyzed for exchangeable calcium and potassium.

The harvested tubers were sorted into four classifications of scabbiness, weighed, and specific gravity of a representative sample from each plot was determined.

In 1951, as the calcium-potassium ratio approached one, there were increased yields and reduced scabbiness on Katahdin potatoes.

No general trends resulted from lowered calcium-potassium ratios in 1952. Yield increased with the first three increases in exchangeable potassium content of the soil. The picture presented by that year's data did not confirm the initial trends of the 1951 data.

The yields, percent scab, and scab index showed that Chippewa and Sebago potatoes did not respond favorably to the addition of potash in 1953. Katahdins showed trends of lowered scab index and increased yields similar to those of 1951 but of less magnitude.

Zinc did not decrease the percent of scabby tubers, the scab index, or percent heavy scab. No increase of yield resulted from the addition of zinc. The potash treatments did significantly increase yields.

The greenhouse data showed that lime placed at the nine inch depth did not reduce scabbing nor increase yield at either pH. Chippewas from Emmet fine sandy loam at pH 5.6 with 1000 pounds per acre of lime mixed throughout the top nine inches of soil were the most scab-free and largest of all the harvested tubers.

The exchangeable potassium in the soil and the total potassium in the potato leaves increased in a manner consistent with the increments of potash applied. The relationship between the calcium-potassium ratios in leaf and soil samples was evidenced by their similar curves.

The addition of as much as 450 pounds of potash per acre had no adverse effect on the cooking quality of Katahdin potatoes as measured by the specific gravity.

64 pages. \$2.00. Mic 57-2307

INHERITANCE OF INFLORESCENCE TYPE AND A STUDY OF ENVIRONMENTAL FACTORS AFFECTING FLOWER SHEDDING IN SOYBEANS

(Publication No. 21,319)

Peter Hendrik van Schaik, Ph.D.
Purdue University, 1957

Major Professor: A. H. Probst

The inheritance of pedunculate and sessile inflorescence types, was studied in six crosses between four varieties of soybeans. Pedunculate plants bear all flowers on axillary peduncles which vary in length. In sessile plants, flowers are attached individually to the leaf axils or borne on very short racemes.

Pedunculate inflorescence type was found to differ from sessile inflorescence type by one factor pair. The symbols *Se* and *se* were assigned to this allelomorphic pair. Inflorescence type was found to be independent from growth type and flower color but closely associated with plant height and maturity.

Using the progenies of the same six crosses, an attempt was made to investigate the nature of segregation, gene action, and estimates of heritabilities and numbers of genes involved in the quantitative characters, peduncle length, flowers per node and percentage flower shedding. F_2 frequency distributions and F_1 and parental means indicated partial dominance of genes conditioning long peduncles, high flower number, and high shedding percentage. Considerable environmental influence was found to be present from the within and between year variations in the parents in all three characters. Heritability estimates were highest for flower number and peduncle length and relatively low for percentage shedding, indicating the greatest environmental fluctuations in the latter character. Estimates of gene numbers were lowest for peduncle length and highest for shedding percentage. All estimates were considered too low on account of the conditions which did not fulfill the requirements for the application of Castle-Wright's formula. Gene action determinations were inconclusive for peduncle length and flower number but indicated additive gene action in determining percentage shedding.

Highly significant positive correlation coefficients indicated close association between peduncle length and flower number, and between flowers produced and the percentage lost by shedding. Coefficients of correlation between flowers and pods per node were inconsistent in the various crosses, indicating that high flower producing capacity does not necessarily contribute to high yield.

Controlled climatic conditions of temperatures and photoperiods were used in an attempt to investigate the specific influence of these environmental factors on reproductive efficiency. Constant temperatures of 60° F retarded all plants considerably in vegetative as well as reproductive growth. In general both varieties used flowered earlier and more profusely under higher temperatures. The shortest photoperiod, 12 hours per 24 hour cycle, was most conducive to early flowering but longer photoperiods produced greater numbers of flowers. The greater flower production was considered partly a consequence of greater vigor of the plants. The effects of temperatures and photoperiods on pod set were not statistically significant. Consequently shedding of flowers generally followed similar trends as flower production, and was

increased by higher temperatures and longer photoperiods. Shedding was not caused by a lack of viable pollen. Day temperatures were found to limit flower production before night temperatures. Not until day temperatures were sufficiently high to allow formation of a considerable number of flowers, did night temperatures exert a depressing effect.

Shedding behavior of four varieties was investigated under field conditions. The varieties, Mukden, T109, Acc.2300-2, and Midwest shed 42.7, 73.3, 62.1, and 81.0 percent respectively. No shedding of flower buds was observed. Shedding of pods during various stages of development contributed from 1/3 to 1/2 of total shedding in all varieties. Varietal differences were mainly due to differences in shedding of mature flowers. Ovules of shed pods were translucent yellow to brown in color and shriveled in appearance. Failure of pollination and fertilization were considered two major causes of flower and pod shedding.

No significant correlations were found between daily maximum temperature and shedding or minimum relative humidity and shedding. Correlation coefficients for temperatures and shedding approaching significance were obtained by assuming a three day lapse between cause and effect of the temperature stimulus.

Six chemical growth regulators, applied weekly as sprays to flower clusters at or just prior to anthesis, were unsuccessful in increasing the reproductive efficiency of the variety Midwest. 147 pages. \$2.00. Mic 57-2308

NITROGEN LOSSES FROM SOILS, AS MODIFIED BY FERTILIZER MANAGEMENT

(Publication No. 21,107)

George Henry Wagner, Ph.D.
University of Missouri, 1957

Supervisor: George E. Smith

Five different nitrogen carriers and eight different soil types were selected for the study of denitrification of fertilizer nitrogen. These soil-nitrogen combinations were incubated under controlled conditions and losses of nitro-

gen from them were measured by the difference in total nitrogen at the outset and the close of a given period of time. Inorganic nitrogen measurements were, also, made at intervals throughout a period of eight weeks.

The results have supported the hypothesis that nitrogen fertilizer treatments may undergo losses by denitrification. The measured losses ranged up to 85 per cent of the treatment. The evidence shows that medium-textured soils with intermediate amounts of organic matter are least apt to suffer these losses.

The standard analysis for total nitrogen in soil proved adequate for measuring changes in total nitrogen with sufficient precision to detect losses of nitrogenous materials by denitrification.

Indications of some mechanisms of nitrogen losses were obtained by the measurement of gaseous nitrogen products evolved from soil. It was established that losses involve volatilization of nitrogen gases other than elemental nitrogen. A very small amount of nitrogen may be lost by volatilization as ammonia. Also, small losses may occur in the form of nitric oxide or nitrogen dioxide. Nitrous oxide, on the other hand, may account for a large part of the nitrogen lost under certain conditions which lead to denitrification. The further reduction of nitrous oxide under other conditions would give rise to elemental nitrogen as the major gas evolved.

The rate of nitrification of ammonium materials in an acid Putnam silt loam was increased by the addition of calcium to this soil. Ammonium sulfate was not as readily nitrified in an acid soil as was aqua ammonia or urea, no doubt as a result of the acidity associated with the sulfate radical.

Surface application of nitrogen materials resulted in a very high salt concentration in a small volume of soil. In the case of surface-applied urea, the pH of this surface layer of soil was increased sufficiently so that free ammonia was lost to the atmosphere.

The results of this study also suggest that high concentrations of nitrite may develop in soils receiving large nitrogen additions. It was established that treatments which lead to the presence of free ammonia in the soil would result in this condition.

The facts of this study emphasize the importance of considering the soil conditions and the forms of nitrogen applied if serious losses are to be prevented.

136 pages. \$2.00. Mic 57-2309

BACTERIOLOGY

STUDIES ON THE TOXIN OF PASTEURELLA PESTIS

(Publication No. 21,513)

Donald Frederick Bent, Ph.D.
University of Maryland, 1957

Supervisors: Dr. John E. Faber, Jr., Dr. Samuel J. Ajl

A large scale method of producing the toxin of Pasteurella pestis was developed. A casein-hydrolysate-mineral-glucose medium was adapted for use with 16 L of culture

medium in 20 L carboys. Sufficient aeration was a critical requirement for maximum toxin production. The use of two fine pored gas diffusion stones and a negative pressure system provided efficient aeration of the carboy culture. Uncontrolled foaming, which caused reduced yields of toxin, was prevented by addition of sterile Dow Corning Antifoam A to the surface of the medium. After 8 to 9 days incubation at 30 C, toxin, released from the cells by autolysis, was harvested by precipitation with the addition of ammonium sulfate to saturation, after removal of cell debris by Sharples centrifugation. From 16 L of carboy culture

12-15 g of crude plague toxin was harvested. The method is much more economical of time, labor and materials per g of toxin produced than methods heretofore reported.

The effect of iron concentration in the production of plague toxin was investigated. Using deferrated synthetic media, it was found that the iron concentrations were critical only in that very large or minimal concentrations of iron in the medium resulted in reduced cell yields which in turn resulted in decreased toxin harvests. However, in agreement with Goodner's (1955) findings, it was found that cultural conditions which reduced vegetative growth of *P. pestis* produced cells of greater toxigenic potentiality. A complete mineral analysis of purified plague toxin showed that iron was not a component of the toxin.

A complete amino acid analysis of purified plague toxin was performed. Column chromatography of the acid hydrolyzed toxin on polystyrene ion exchange resin, followed by colorimetric quantitative ninhydrin reactions, were employed as the primary analytical procedure. Tryptophane, methionine, and cysteine were determined by other methods. Eighteen acids were identified and quantitated with over 98 per cent recovery on a dry weight basis. The following weight in g of amino acids per 100 g of toxin were recovered: aspartic 10.9, threonine 7.2, serine 5.4, glutamic acid 12.1, proline 3.5, glycine 4.1, alanine 6.9, valine 5.5, methionine 1.5, isoleucine 4.3, leucine 7.8, tyrosine 3.2, phenylalanine 5.3, histidine 3.2, lysine 5.3, arginine 5.0, tryptophane 3.3, cysteine 1.3, and ammonia 2.3. A molecular weight of 74,000 was used in all calculations. The presence of a large proportion of acidic amino acids was the only noteworthy characteristic of the amino acid composition of the toxin.

Plague toxin is relatively unstable, particularly in regard to the loss of toxicity. In order to conduct various analytical procedures with toxin, a means of differentiating loss of toxic activity due to specific chemical or physical reactions from the loss of toxicity due to denaturation, was developed. It was found that the use of toxicity measurements, serological diffusion precipitation reactions (Ouchterlony technique), quantitative ninhydrin determinations and quantitative sulfhydryl determinations together, provided a pattern of reactions by means of which analytical experiments with toxin could be interpreted. Denaturation of plague toxin by physical and chemical means resulted in early loss of toxicity followed by a more gradual loss of serological activity. At the same time the number of sulfhydryl and ninhydrin reacting groups increased except in heat denaturation during which there was a decrease in ninhydrin reacting groups. Making use of this procedure, it was determined that trypsin, chymotrypsin and papain, under the conditions established, were useful agents for the partial hydrolysis of plague toxin suitable for the recovery and analysis of molecular fragments bearing toxic and serological activity. 69 pages. \$2.00. Mic 57-2310

STUDIES ON SOLUBLE AND INTACT BRUCELLA ABORTUS ANTIGENS

(Publication No. 21,691)

Rene J. Bienvenu, Jr., Ph.D.
The University of Texas, 1957

Supervisor: V. T. Schuhardt

Literature reports and experience in this laboratory indicate a reverse correlation between the agglutinin titers and brucellacidal activity of undiluted sera from cows infected with, and rabbits immunized with *Brucella abortus* cells. The original objective of this research was (1) to determine whether or not *B. abortus* agglutinogens and brucellacidinogens were antigenically identical, and (2) to attempt to extract from *B. abortus* cells a soluble haptene, with the specific reactivity of the agglutinogen, for possible use in *in vivo* binding of *B. abortus* agglutinins.

An agglutinin binding (BAAB) technique was devised to test extracts of *B. abortus* for *in vitro* evidence of antigenicity. When the BAAB test for incubated at 4-6 C for 4 hours and then centrifuged at 3,000 rpm, it worked satisfactorily with intact cell antigens, but failed to show antigenicity of extracts or disintegrates of *B. abortus* cells. However, when the primary reaction mixtures in the BAAB test were centrifuged at 20,000 rpm for 30 minutes, the agglutinin binding capacity of 3 soluble *B. abortus* antigens was proved. Also incubation of the BAAB test at 37 C made possible the *in vitro* demonstration of antigenicity of some soluble *B. abortus* antigens after centrifuging at 3,000 rpm for 30 minutes.

This *in vitro* proof of agglutinin binding by the soluble *B. abortus* antigens raised the question of how these bound agglutinins, when not removed by centrifugation, were capable of reacting with and agglutinating subsequently added *B. abortus* cells (the agglutination test antigen). Experimental evidence is presented which indicates that the bound agglutinins are dissociated from the soluble *B. abortus* antigens and rebound by the intact *B. abortus* cells which then agglutinate. The freed soluble antigen then was proved capable of binding freshly added agglutinins by subjecting these mixtures to the high speed BAAB testing technique. These observations may prove to be of value in the isolation and purification of specifically reacting soluble antigens of this type.

A relatively rapid and inexpensive technique for testing immune rabbit sera for the presence of brucellacidal antibody has been developed and used to study the response of animals to the injection of various types of *B. abortus* antigens. A Neisser-Wechsberg antibody excess zone of inhibition of killing was observed in the sera which showed high agglutinin titers in all but one of the rabbits tested. This zone was reversed by absorption of the agglutinins with either intact or soluble *B. abortus* antigens. The residual presence of brucellacidal activity in sera not showing demonstrable agglutination is believed to be due to the greater sensitivity of the brucellacidal test, rather than qualitative differences between the antibodies or antigens involved in the two tests.

112 pages. \$2.00. Mic 57-2311

A STUDY OF PURIFICATION PROCEDURES AND
NUCLEIC ACID ANALYSIS OF NEWCASTLE
DISEASE VIRUS

(Publication No. 21,750)

Gabriel Angelo Castellano, Ph.D.
Kansas State College, 1957

Many investigators have attempted, with varying degrees of success, to determine the nucleic acid composition of viruses. These determinations have been made mostly on plant, bacterial and insect viruses. Relatively few attempts have been made on animal viruses.

In view of the disparate results obtained with influenza virus A, strain PR 8, and the doubt associated with the work of Cunha on Newcastle disease virus, and since both influenza and Newcastle disease viruses fall into the same homogeneous group, along with mumps virus, it was felt desirable to determine the nucleic acid composition of Newcastle disease virus, using the more sensitive analytical techniques of Ada and Perry. Also, it was realized that studies of this nature are of great importance in scientific research because the key to viral chemotherapy, heredity, protein synthesis, cancer, efficient vaccines, the nature of life itself and perhaps other biological problems may lie in the structure and function of viral nucleic acids.

The nucleic acid composition of several strains of Newcastle disease virus was determined by three methods. The first determination was made on virus material purified by adsorption to and elution from red blood cells followed by two cycles of differential centrifugation. Results indicated that the paucity of spots of nucleic acid derivatives obtained was due to an insufficient quantity of starting material and the lack of a good purification procedure for Newcastle disease virus rather than to a loss of viral material in one of the latter steps of the extensive procedure employed.

The experimental results of the second determination, made on virus material purified by differential centrifugation, indicated that this hypothesis was valid and that the many purification and analysis procedures were performed adequately. These results also indicated that a more decisive analysis would require greatly increased quantities of starting material and certain equipment involved in the purification procedure.

Because of the limitations of the laboratory in which this work was performed a short-cut method was used for the third determination. This final nucleic acid determination was done by subtracting control contamination values from values of virus of questionable purity. The base thymine, characteristic of DNA, was found in one strain of Newcastle disease virus. However, it could not be stated that DNA is a component of this strain, since the possibility exists that this sample contained contaminants from the host cell and fowl red blood cells.

73 pages. \$2.00. Mic 57-2312

STUDIES ON THE METAL REQUIREMENTS OF
CLOSTRIDIUM PERFRINGENS LECITHINASE
USING CHELATING AGENTS

(Publication No. 21,276)

Merwyn Walter Deverell, Ph.D.
Purdue University, 1957

Major Professor: Merwin Moskowitz

The inhibition of *Clostridium perfringens* lecithinase by ethylene di-amine tetraacetic acid (EDTA) and sodium citrate was studied utilizing the Warburg technique (Zamecnik et al., 1947) and lecithovitellin (LV) tests. A problem of variation among duplicate Warburg experiments, which existed when using crude culture filtrates as a source of lecithinase, was minimized through the use of concentrated lecithinase preparations. An adaptation of the method of Roth and Pillemer (1953) for the concentrating of lecithinase was developed in order to obtain concentrated lecithinase suitable for Warburg analysis.

The results of the Warburg analysis of lecithinase showed that a mixture of twenty milligrams of lecithin and an amount of lecithinase which resulted in lecithin breakdown to the extent that 240 μ l of carbon dioxide was evolved in 120 minutes was completely inhibited by 2.73×10^{-3} millimoles of EDTA. 2.4×10^{-3} to 4×10^{-3} millimoles of either zinc or cobalt reversed this inhibition. 3×10^{-3} millimoles of manganese reversed the inhibition. Higher or lower concentrations of manganese did not reverse EDTA inhibition. 3×10^{-3} millimoles of either cuprous or ferrous ions partially reversed EDTA inhibition. Up to 4×10^{-3} millimoles of calcium, magnesium, cadmium, barium, or strontium had no effect on EDTA inhibition.

EDTA inhibition studies using the LV test duplicated the Warburg studies on a qualitative level.

Using the Warburg technique it was found that 4×10^{-3} millimoles and 2×10^{-3} millimoles of sodium citrate decreased lecithinase activity to two-thirds and one-fifth respectively of its normal rate.

The partial inhibition by sodium citrate was reversed by equimolar concentrations of zinc, cobalt, manganese, magnesium, or calcium. Cadmium, barium or strontium had no effect on citrate inhibition and cupric or ferrous ions inhibited lecithinase activity even beyond that of citrate inhibition.

When lecithinase was dialyzed against water for five days, the lecithinase was found to be one-half as active as undialyzed lecithinase. The addition of zinc or cobalt ions had a marked activating effect on the dialyzed lecithinase and the addition of calcium, magnesium, or manganese activated it slightly. After dialysis of a lecithinase-EDTA mixture against water, the lecithinase was found inactive and only zinc reactivated it to an appreciable extent.

The EDTA inhibition reversal studies indicated that calcium was not the essential metal required for lecithinase activity as had been suggested by earlier workers. The precise metal requirement is still obscure, however, the possibility of zinc, cobalt, manganese, or copper fulfilling this requirement is indicated. The results using lecithinase dialyzed in the presence of EDTA suggest zinc. The citrate inhibition reversal studies were not in complete agreement with the results of the EDTA inhibition studies. These results suggested a direct activating or inhibitory effect of the lecithinase by the metals in a

partially inhibited system rather than a reversal of citrate inhibition.

An agar diffusion plate method for the assay of lecithinase was developed. 169 pages. \$2.25. Mic 57-2313

ASPECTS OF THE INGESTIVE AND CYTOPEPTIC ACTION OF PHAGOCYTES

(Publication No. 21,684)

Ko Ko Gyi, Ph.D.
University of Utah, 1957

Chairman: Dr. Stanley Marcus

Total body x-irradiation of mice in doses of either 300, 400 or 500 r does not affect the phagocytosis by reticulo-endothelial cells of ThO_2 on the second postirradiation day. Similar studies carried out on the seventh postirradiation day revealed that 300 r or 400 r of whole body x-irradiation also had no influence on the phagocytosis whereas a dose of 500 r significantly depressed the phagocytic activity of the reticulo-endothelial cells. A dose of 550 r (LD_{50}) significantly depressed the phagocytosis of ThO_2 in LAf_1 mice whereas a comparatively high dose, 500 r (LD_{99}) is required to suppress the phagocytic function in adult albino mice. These observations indicated that the effect of x-irradiation on phagocytosis by reticulo-endothelial cells is dependent on the x-irradiation dose, the postirradiation period of observation that phagocyte function was measured and the strain or species of animals employed.

Chronic exposure of mice to x-irradiation in doses of 25 r at intervals of 2 days, until accumulated doses reached as high as 600 to 825 r, failed to yield alterations in the phagocytic activity of reticulo-endothelial cells or the cytopeptic activity of the peritoneal phagocytes.

Whole body x-irradiation of mice (350 to 450 r) and rabbits (600 r) significantly depressed the intracellular digestion of chicken erythrocytes by peritoneal phagocytes on the sixth postirradiation day.

Immunization with chicken erythrocytes caused an increase in the digestive activity of phagocytes which was found to be independent of antibody action. The hypothesis was offered that this immunization induced alterations in phagocytes is a result of adaptive enzymes formation.

Piromen in doses of 1 ug per injection given subcutaneously in mice twice daily for 3, 5 or 7 days; or doses of 0.1 ug given for 5 or 7 days significantly increased the cytopeptic activity.

No significant difference in overall mortalities existed between mice treated with leucocytes from immunized mice and those treated with leucocytes from normal mice when challenged with K. pneumoniae.

115 pages. \$2.00. Mic 57-2314

A STUDY OF SOME FACTORS AFFECTING GROWTH AND OXIDATIONS OF ACETOBACTER ACETI

(Publication No. 21,394)

Henry Paul Meloche, Jr., Ph.D.
Michigan State University, 1956

A study was made of factors affecting the growth and oxidations of Acetobacter aceti in mineral medium containing ethanol. It was found that the organism would not grow unless dextrose was included in the mineral medium. In a mineral salts dextrose medium, growth was stimulated by the presence of pantothenic acid, folic acid, thiamine and biotin. However, the acid production of only one of the two strains studied was stimulated in the presence of the above vitamins. There was no stimulation of the organism by amino acids.

Cell suspensions of both strains of A. aceti oxidized ethanol to acetate, but would not oxidize dextrose, gluconate, pyruvate, or acetate. The addition of the vitamins listed above did not "spark" the oxidation of either dextrose or acetate. However, evidence was presented which indicated that cell suspensions grown in a medium containing dextrose and yeast extract would completely oxidize ethanol and acetate, and partially oxidize dextrose.

Experimental pilot plant vinegar generators were inoculated with A. aceti, started and maintained on a mineral medium containing dextrose and ethanol. This study indicated that the major factors to be controlled in the generators were the concentrations of ethanol and dextrose, and the air supply. Vinegar eels did not affect the rate of vinegar production in normally functioning generators.

57 pages. \$2.00. Mic 57-2315

COMPARATIVE SEROLOGICAL AND PHYSIOLOGICAL STUDIES OF THE SUBGENUS THERMOBACTERIUM

(Publication No. 21,533)

Robert Harvey Miller, Ph.D.
University of Maryland, 1957

Supervisor: Dr. P. Arne Hansen

A serological investigation was conducted in which a number of species of the subgenus Thermobacterium Orla-Jensen were studied and compared with strains of known antigenic structure. One species belonging to the subgenus Streptobacterium Orla-Jensen (Lactobacillus casei) was included since most of the major antigens reported in the literature were contained in a series of standard typing strains belonging to this species.

A collection of 52 strains of lactobacilli, representative of five species (Lactobacillus lactis, Lactobacillus acidophilus, Lactobacillus helveticus, Lactobacillus bulgaricus and Lactobacillus casei) and obtained from a variety of sources and geographic locations, was studied by means of cell agglutination and agglutinin absorption tests. Rabbit sera against many of these strains were prepared by repeated intravenous injections of washed live suspensions of these organisms.

All strains employed in the serological investigations

were studied physiologically and identified as to species according to the scheme proposed by Orla-Jensen, Tittsler, Geib and Rogosa, and Rogosa *et al.*

A comprehensive cross agglutination study indicated that there is much heterogeneity within the various species, and the antigenic pattern appeared very complex. This fact seems to be particularly evident with the *L. acidophilus* species.

A detailed study of the *L. lactis* species led to the identification of two distinct antigenic components which have not been described so far in other species of the genus. *L. lactis* (Orla-Jensen) Holland has an antigen which seems distinct from the antigens A, B, C, D, E, F, G, H, and I by Williams and Orland. This particular antigenic component has been found in every authentic *L. lactis* strain investigated and so far has not been demonstrated in other homo-fermentative lactobacilli. It is proposed to call it K or in the new terminology of Williams, Norris and György, I-10. Rabbit sera prepared from *L. lactis* strain Dorner ATCC 8000 absorbed with cells of *L. casei* strain Tittsler 318, seems specifically to agglutinate *L. lactis*.

A monospecific K serum has been prepared which is highly specific and selective for *L. lactis* and is of practical significance in the differentiation of *L. lactis* from *L. acidophilus*.

Further investigations led to the identification of another distinct antigen in *L. lactis* strain Rogosa G-74. This particular *L. lactis* strain exhibits an antigen previously not found in any other *Lactobacillus*. It is proposed to call this antigenic component L or I-11 in the terminology of Williams *et al.* Rabbit sera prepared from *L. lactis* G-74 and absorbed with cells of *L. lactis* strain X-37 (National Research Council of Canada) or *L. lactis* strain L3 (National Institute for Research in Dairying, Reading, England) results in an absorbed serum that only reacts with its homologous cells. This antigen appears to differ from any described by Williams and Orland as well as any contained in the other *L. lactis* strains.

Monospecific sera prepared according to the procedure by Williams and Orland, and representing antigens A, B, C, D, E, F, G, H, and I were used to analyze the antigenic components of a collection of 15 authentic strains of *L. lactis*. These may be tentatively arranged in 3 categories on the basis of their reactivity in the specific typing sera. Some of the *L. lactis* strains (a) did not react to a significant titer with any of the monospecific sera, A through I, while other strains (b) were moderate in their degree of reactivity and a third group (c) reacted with most of the specific sera and appeared to be very complex antigenically.

Agglutinin absorption tests further substantiated the presence of types within this species. The diversity and complexity of the antigenic types within the *L. lactis* species appear to be considerable.

A close agreement between the physiological characterization of the species *L. lactis* as defined by Orla-Jensen and the presence of antigen K has been established.

The present investigation indicates that additional major antigens will most likely be found when further species in this genus are subjected to detailed antigenic analysis.

104 pages. \$2.00. Mic 57-2316

COMPARATIVE STUDIES ON SOME GRAM-POSITIVE PHYTOPATHOGENIC BACTERIA AND THEIR RELATIONSHIP TO THE CORYNEBACTERIA

(Publication No. 20,842)

Coimbatore S. Ramamurthi, Ph.D.
Cornell University, 1957

The Gram-positive phytopathogenic bacteria, previously described separately and placed in various genera in several different classifications have been recently treated as a single group belonging to the genus *Corynebacterium*. Whether the transfer of these Gram-positive plant pathogens to the genus *Corynebacterium* is justified, has been questioned by some bacteriologists on the grounds of morphology, motility, and certain other physiological characteristics. It also has been mentioned that the phytopathogenic corynebacteria differ widely from the animal parasitic corynebacteria.

Therefore, six plant pathogens (*Corynebacterium fascians*, *C. flaccumfaciens*, *C. insidiōsum*, *C. michiganense*, *C. poinsettiae* and *C. sepedonicum*), two animal pathogens (*C. equi* and *C. renale*) and one soil saprophyte (*C. creatinovorans*) were examined critically, using refined techniques, to ascertain how far they resemble morphologically, physiologically and nutritionally, acknowledged species of corynebacteria.

It is concluded that cellular morphology of these species is governed by physical and nutritional factors as has been reported for the type species of *Corynebacterium*. Two distinct morphological groups of the bacteria studied are recognized on the basis of cellular and colony morphology on solid media. One group, like most bacteria, produces moist, filiform, entire colonies made up of predominantly unicellular elements. The second group shows tendencies for continued growth after cell division, without cell separation; its colonies resemble species of actinomycetes in being relatively dry, rugose, undulate and in possessing fragmenting multicellular structures.

It is considered that the group which includes unicellular organisms is representative of the true corynebacteria. The species *Corynebacterium flaccumfaciens*, *C. insidiōsum*, *C. michiganense*, *C. poinsettiae*, *C. sepedonicum*, *C. equi* and *C. creatinovorans* belong here.

This group is characterized by variations in cellular morphology with only an occasional tendency for cell aggregation in small groups. Its reactions to stains are traceable to favorable nutritional conditions. Motility is regarded as an unimportant character generically.

All the organisms studied are aerobes. The plant pathogens tolerate and grow, at temperatures lower than those required by the animal parasites.

The corynebacteria differ in their proteolytic ability when tested on different media. In milk, their reactions vary quantitatively, for the saprophyte and motile phytopathogens are more proteolytic than the others. All species clear milk slowly with the accumulation of clear serum at the surface; and without any wide alteration in pH. Litmus and methylene blue are reduced gradually by a majority of species.

The carbon metabolism shows a wide spectrum of reactions ranging from fermentation of glucose, maltose and sometimes sucrose with the formation of acid but no gas, to a complete oxidation and little acid formation. The

motile species are more fermentative than the others studied. All species hydrolyze esculin.

Typical corynebacteria do not reduce nitrates. They may utilize feebly ammonium salts provided growth factors and glucose are present; but they thrive well on organic nitrogen without the supplement of carbohydrate. They possess the ability to oxidize organic compounds containing both carbon and nitrogen such as creatine, uric acid, purines and pyrimidines. They possess deaminase activity but not urease activity.

The corynebacteria do not produce hydrogen sulfide, indol or acetyl-methyl-carbinol. They are neither diastatic nor lipolytic. They do not decompose tyrosine. Nutritionally the pathogenic species show a need for thiamin and histidine.

The second morphological group includes Corynebacterium fascians and perhaps C. renale and is widely different in morphology and physiology from the group described above. They produce characteristic alkaline reaction even in the presence of carbohydrates and in milk. They do not hydrolyze esculin, and show preference for arginine. They do not reduce litmus or methylene blue. Furthermore, C. fascians produces hydrogen sulfide, is lipolytic and decomposes tyrosine slowly. As these species morphologically and physiologically resemble the Nocardia, it is considered that they should be called species of this genus.

The generic value of the characters investigated are discussed from the view point of the genera, Corynebacterium, Nocardia, and Mycobacterium.

122 pages. \$2.00. Mic 57-2317

BIOGRAPHY

THE PUBLIC LIFE OF HENRY DEARBORN

(Publication No. 21,604)

Richard Alton Erney, Ph.D.
Columbia University, 1957

Although Henry Dearborn was prominent in early United States history, no adequate biography of him has appeared. This study of Dearborn's public career is based principally on manuscript and published primary sources.

In the Revolutionary War, Dearborn attained the rank of lieutenant-colonel and proved himself a courageous and effective leader, particularly in the battles of Bemis Heights, Freeman's Farm, and Monmouth. However, he commanded no unit larger than a regiment, and a year's staff duty as Deputy Quartermaster General yielded little administrative experience.

Elected to the United States House of Representatives from the District of Maine, Dearborn distinguished himself from 1793 to 1797 only in his adherence to the rising Republican party, his advocacy of economy in military expenditures, and his opposition to the Jay Treaty.

Dearborn gained national prominence as Jefferson's Secretary of War from 1801 to 1809. During Jefferson's first term Dearborn reduced military expenditures by decreasing the regular army and halting construction of fortifications. At the same time, he introduced Whitney's muskets, new gun carriages, and established the first properly equipped light artillery. Although Dearborn put the United States Military Academy in operation, he gave it no leadership.

Beginning in 1806 and increasingly after the Chesapeake-Leopard crisis in 1807, Dearborn worked to rebuild the nation's defenses. He accomplished more than historians have recognized, building fortifications, enlarging the army, and increasing arms production. However, Congress refused to enact important parts of the administration's limited defense program and the United States was still unprepared for war in 1809.

Dearborn and Jefferson originally intended to acquire

Indian lands gradually. Threat of French occupation of Louisiana in 1802 caused Jefferson and Dearborn to press for cessions on the Mississippi and Ohio Rivers which would shut the Indians off from foreign neighbors and provide homes for militiamen to protect the west. Under this policy Dearborn obtained treaties ceding millions of acres to the United States. At the same time he kept the Indians at peace, although Indian unrest increased after 1805. To counteract the influence of foreign traders and secure Indian good-will, Dearborn greatly expanded the government system of Indian trading factories. He also encouraged government and privately sponsored projects to teach the Indians agriculture and the basic arts of white civilization.

After three years as Collector of Customs at Boston, Dearborn in 1812 reluctantly accepted command of the army that was to invade Canada. Because of the country's unpreparedness for war, confusion of commands, poor generalship, and the refusal of militiamen to enter Canada at crucial times, the campaign of 1812 ended disastrously, with Detroit and much of the northwest in the hands of the British and Indians. Dearborn's offer to resign was not accepted.

In the campaign of 1813 Dearborn's forces successfully captured York (Toronto) and Forts George and Erie on the Niagara River. In both instances, however, Dearborn failed to destroy the enemy armies, and the campaign halted when he became seriously ill. Dismissed from command on the Canadian frontier, Dearborn served the remainder of the war at New York and Boston.

In 1817 Dearborn was the unsuccessful Republican candidate for governor of Massachusetts. From 1822 to 1824 he was United States Minister to Portugal. The mission ended Dearborn's public service and he died in 1829.

Dearborn's nationalistic attitudes and interest in practical science were typical of his time. As a public official he was honest, industrious, intelligent, and a loyal Republican. Contributing relatively little to the formation of basic public policies, Dearborn possessed the ability and practical knowledge to execute the policies of his superiors

with considerable success. These qualities obtained for him the patronage, friendship and respect of four Presi-

dents and others less prominent.

397 pages. \$5.10. Mic 57-2318

BIOLOGY - GENETICS

BIOLOGY, GENETICS

THE BIOLOGICAL CONTROL OF VERTICILLIUM ALBO-ATRUM R. & B., BY VARIOUS ANTAGONISTIC MICROORGANISMS

(Publication No. 19,407)

Gino V. Grassi, Ph.D.
Purdue University, 1956

Major Professor: C. L. Porter

It has been long known that the composition of soil microflora can exert a controlling influence on soil-borne plant pathogens. This effect is closely related with microbial antagonism. When a soil has been sterilized, competition between microorganisms is reduced or eliminated; when such a soil is invaded later by a parasite, the disease spreads much more quickly and is more virulent than in natural non-sterilized soil. Thus the microflora of the soil acts as a barrier to the invader. Verticillium albo-atrum R & B., according to the conception of soil-inhabiting fungi and soil-invading fungi, as employed by Garrett (18) to distinguish between two contrasting types of behaviour amongst the root-infecting fungi, can truly be classified as a soil-invading fungus.

It has been observed in our study that soil amendments stimulate the development of various saprophytes in the soil. These multiply at the expense of the pathogens and are able to check their activity by preventing their growth.

In preliminary tests, organisms antagonistic to V. albo-atrum have been isolated from muck soils. All indications show that the degree of wilt incidence is related to the number of organisms present in muck soil, which are antagonistic to the causal agent. These microorganisms, when introduced singly into soil inoculated with the disease agent, and when various amendments were introduced into the soil in order to stimulate development of the antagonists, have given excellent control of the silt producing fungus.

It has been suggested that the microflora may also play a significant role in the biological control of the disease. It has been our observation that the microflora of the soil region adjacent to the roots of growing plants, differ quantitatively and qualitatively from the indigenous flora of the surrounding soil.

The use of soil amendments, moreover has altered the balance of the constituent microbial groups in the rhizosphere, so that potentially harmful fungi are replaced by various saprophytic, non-pathogenic microorganisms.

It would appear, therefore, that the establishment and maintenance by appropriate soil amendments of a rhizosphere microflora hospitable to particular antagonistic agents, are very important approaches to biological control

and ones which should be given much more extensive and exhaustive trials. 55 pages. \$2.00. Mic 57-2319

COMPARISON OF THE EFFECT OF ENVIRONMENTAL TEMPERATURE ON RABBITS AND CATTLE

(Publication No. 21,102)

Harold David Johnson, Ph.D.
University of Missouri, 1957

Supervisor: Professor A. C. Ragsdale

With the conspicuous exception of the absence of rumen with associated compensatory adjustments, rabbits are similar in most respects to European breeds of cattle in the nutritional and climatic physiology. This investigation is to determine by comparative physiological and biochemical measurements, the desirability of the rabbit as a pilot-experimental animal for cattle in bioclimatic studies.

The data presented in this dissertation are divided into two main categories: (1) growth studies, and (2) temperature series study.

The Shorthorn, Zebu, and Santa Gertrudis heifers data were selected to compare with the data of rabbits during growth at controlled temperatures (50° and 80°F.); for the comparison of the mature rabbit's physiological reactions to rising environmental temperatures, the data on Holstein, Jersey, Brown Swiss, and Zebu cows were used.

Heat production determinations were made by the following measurements: For example, resting metabolism and associated functions such as thyroid activity, feed consumption, and heart rate.

Heat dissipation determinations were made by such measurements as evaporative cooling (both surface and respiratory) and associated functions such as water consumption, excretory moisture loss, and non-evaporative cooling (by animal air-temperature gradients).

The growth studies data indicated that body weight gains were less in the Shorthorns and in the rabbits raised at 80° and 83°F. as compared to those at 48° and 50°F. Less differences were observed between the Zebu and Santa Gertrudis raised at 50° and 80°F. The heat production and thyroid activity of both rabbits and calves were lower at the higher temperature (80° or 83°F.). Pulse rate decreased in both species with advancing age. However, there was an apparent species difference in pulse rate in response to environmental temperatures--rabbit pulse was higher at 83°F. than at 48°F., whereas calf pulse was lower at 80° than at 50°F.

The most efficient gains were made by the rabbits and calves in the early stages of life and declined thereafter.

Evaporative cooling in both species increased per animal with increasing age, but decreased when expressed per unit weight. In both species the evaporative cooling was higher at the higher environmental temperatures (80° and 83°F.).

The data on temperature series study reveal that in both species an explosive rise in respiration rate occurred at 75°F.; abrupt increase in rectal temperature at around 80°F. with corresponding decline in feed consumption, heat production, and thyroid activity. The thyroid activity, heat production, and feed consumption data also indicated a strikingly parallelism. In rabbits, as well as cows, the skin, hair, and air temperatures met at about 105°F. environmental temperature with their rectal temperatures at 106°F.--an indication of no heat loss by non-evaporative cooling. Moreover, the partitions of surface and respiratory evaporative moisture loss of rabbits and cows showed a remarkable similarity.

The minor differences between the two species are mainly physical (size) and physiological adaptations to the environment. However, knowledge and understanding of such differences are helpful to environmental physiologists in the sense that they contribute much basic information to some of the intricate mechanisms of heat production and heat dissipation.

229 pages. \$3.00. Mic 57-2320

and Lee wheat, were used in this investigation. In the greenhouse trial in the winter of 1954 plants were divided into three sets in each crop. One set was left untreated and these plants and their progenies served as check. Plants in another set were treated at the tillering stage with 2,4-D amine (8 oz.). Plants of the third set were treated at the pre-boot stage with the same formulation and concentration of 2,4-D. At maturity each spike from a marked tiller of the treated plants was harvested separately. This seed was planted in the field in single head rows in the spring of 1954. All the off-type looking plants were marked.

In the spring of 1955, plant progeny rows from each off-type and a normal plant were grown in the field. All the rows, breeding true or segregating for the off-type, were marked. Notes were taken for the number of days to maturity, amount of tillering, plant height, head length and percent sterility.

Another trial was initiated in the field on the same two varieties in the spring of 1954. In addition to the three greenhouse treatments, ethyl ester of 2,4-D was applied at the two stages of growth.

Sporocyte samples were also taken from the check and the 2,4-D treated plants and their progenies to study the meiotic irregularities caused by 2,4-D treatment.

For the T₁ progenies of barley and wheat (1954), the difference between the check and the two amine treatments, in the number of off-type plants found was not significant. The T₂ progeny data (1955) from both crops demonstrated that the treatments having a higher number of segregating rows had a lower number of off-type rows. There were no significant differences between the various treatments.

Also in barley and wheat, 2,4-D treatment caused no observable or significant changes in number of days to maturity, amount of tillering, plant height, head length and percent sterility. However, using an average of all the treatments, the off-type plants were found to be shorter in height with fewer tillers and increased sterility than the normal plants.

An exceptional result was obtained from the field treated wheat, in the first generation progeny (1955). Significantly higher number of off-type plants were produced by the 2,4-D amine at both the stages of growth and by the 2,4-D ester at the pre-boot stage.

In the treated and the untreated check plants and their progenies very few aberrations in the meiotic cells were observed. The kind of aberration observed most frequently in barley was chromosome stickiness. Wheat displayed a considerable variety of aberrations including lagging univalents, micro-nuclei and aneuploids. The application of 2,4-D on barley and wheat at two different stages of growth caused no significant increase in meiotic irregularities than in the check plants. 91 pages. \$2.00. Mic 57-2321

MUTAGENIC EFFECTS OF 2,4-D IN BARLEY AND WHEAT

(Publication No. 21,258)

Ranbir S. Sandhu, Ph.D.
University of Minnesota, 1957

Adviser: W. M. Myers

The small grains are generally considered resistant to 2,4-D but their resistance is relative. Under certain conditions small grains may show visible effects of treatments. Work of numerous investigators indicates that some stages of growth are less tolerant than others. Considerable literature is available on the effect of rates, formulations and the time of treatment on yield and varietal responses. Very little is reported on the cytogenetical changes caused by herbicides. It is of utmost importance to find out the nature of such disturbances. The studies reported here were designed to evaluate the morphological and the cytological crop responses to 2,4-D in barley and wheat and their transmission through the seed.

Two commonly grown varieties, namely Kindred barley

BOTANY

TAXONOMIC AND ECOLOGICAL STUDIES OF OHIO MOSSES

(Publication No. 21,471)

Robert Marshall Giesy, Ph.D.
The Ohio State University, 1957

In order to investigate and interpret the distribution of the mosses of Ohio, approximately ten thousand specimens from both current collections and herbaria were examined, and their determinations were verified. The annotated list is presented. The history of bryology in Ohio is discussed. A brief review of the forest regions, physiographic provinces, and historical factors in the development of Ohio vegetation is provided as background to interpreting the distribution of mosses. The moss flora of Ohio is divided into three groups: those widely distributed over the state, those restricted to glaciated territory, and those restricted to unglaciated territory. Within these three groups are mosses with northern affinities, tropical affinities, and coastal plain affinities. The migration of these species into Ohio can in part be related to historical factors. There is a definite correlation between distribution of mosses in Ohio and the distribution of certain types of habitats. Thus it appears that there is a need for studies which would examine factors of the micro-environment. This writer suggests that studies of moss associations in Ohio should be undertaken.

166 pages. \$2.20. Mic 57-2322

SOME FACTORS INFLUENCING SOIL MYCOFLORAS

(Publication No. 21,445)

Sankara K. Menon, Ph.D.
The Ohio State University, 1956

Reduction of incidence and severity of root diseases by crop sequences and soil amendments has been attributed to changes in the nature and activity of soil mycofloras affecting soil-borne plant pathogens, but the mechanisms underlying these changes are not very well understood at present. This investigation includes a study of the effect, under controlled conditions in the laboratory and greenhouse, of some of the factors which may be operative in inducing changes in the mycofloras under crops in the field.

A soil-dilution plate technique, as modified at the Ohio Agricultural Experiment Station, was used for the isolation of soil fungi. Fungi were identified to genus, except in the case of the Aspergilli and the Penicillia, which were identified to groups and series respectively. The analysis of variance method was applied to determine differences between the occurrences of various groups of fungi.

Mycofloras of soils continuously cropped to alfalfa, corn, oats, and wheat for two years were different. Higher numbers of colonies of Penicillium funiculosum series and

P. purpurogenum series were isolated from corn soil. The frequency of occurrence of Fusarium colonies was highest in alfalfa soil, lower in oat and wheat soils, and least in corn soil. Higher numbers of Rhizopus colonies were associated with wheat. There appears to be a correlation between the occurrence of Fusarium spp. and members of P. funiculosum series; with increase in the occurrence of P. funiculosum series, the number of colonies of Fusarium spp. decreased, and vice versa. Such a relationship was evident in corn and alfalfa soils.

A striking correlation, on the basis of a seedling disease assay, seems to exist between the occurrence of P. funiculosum series and the low incidence of seedling blights. This positive correlation may be due to the reduction in numbers of Fusarium colonies which cause seedling blights by members of the P. funiculosum series.

The influence of corn and oat plants on the mycofloras was significantly greater than that of their incorporated residues.

The effect of root diffusates of corn and oats was investigated with porous clay bacterial-proof filters, which permitted the diffusion of chemical substances from plant roots into soil without any direct contact between soil and roots. There were significant differences in the frequency of occurrence of certain fungi in soils treated with corn and oat root diffusates.

The effect of temperature and moisture on soil mycofloras was investigated. Soils moistened daily to field capacity (20 per cent by weight) and maintained for five weeks at 10°, 20°, and 30°C. did not differ in the qualitative or quantitative nature of the mycofloras. After seven weeks, there were differences in the mycofloras of soils, whose moisture content fluctuated from 20-8 per cent, 20-14 per cent, and 20-18 per cent by weight. Numbers of colonies of Botrytis spp., P. restrictum series, and total Penicillia decreased with increase in moisture. Soils with distinctly different mycofloras had approximately the same pH.

It is concluded that different, and perhaps characteristic, mycofloras are associated with different crops. Mycofloras can therefore be altered by suitable crop sequences. Desired changes in mycofloras by crops may not in all cases be obtained by the incorporation of residues of the respective crops in soil. A factor of great importance in influencing the mycofloras of soil is the plant itself. Within limits, environmental factors such as temperature, moisture, and pH may be most effective in inducing changes in mycofloras in an indirect manner through their influence on crop plants.

75 pages. \$2.00. Mic 57-2323

VIRULENCE OF SINGLE BASIDIOSPORE ISOLATES OF
 PELLICULARIA FILAMENTOSA AS AFFECTED
 BY PRE-CULTURE SUBSTRATES

(Publication No. 21,458)

Asa Cline Sims, Jr., Ph.D.
 The Ohio State University, 1956

An understanding of the changes that occur in the cells of Pellicularia filamentosa (Pat.) Rogers after culture in various antecedent environments is essential if the parasitism of this organism is to be understood. An investigation of the changes that occur in virulence following pre-culture of this fungus on certain substrates is an approach to the solution of the problem.

Single basidiospore isolates were compared on potato-dextrose agar (PDA), yeast extract agar, and basal agar for cultural characteristics and, after pre-culture on PDA, for virulence. Selected isolates were compared for total mycelium on a vitamin-deficient basal medium and on vitamin-amended basal media. The same isolates were compared after pre-culture on vitamin-amended media at 20° and 30°C. for differences in virulence in contrast to virulence after pre-culture on a basal medium at the same temperatures. A dry-weight basis for determining and standardizing inoculum concentration was developed since basidiospore isolates differed in weight per volume of mycelium after culture on the same media maintained at the same temperature.

Basidiospore isolates differed in growth in a vitamin-deficient medium. No correlation was found to exist between lack of growth on a vitamin-deficient medium and virulence following pre-culture on vitamin-amended media. Basidiospore isolates differed in mycelial weights following culture on a basal medium amended with either biotin, thiamine, or inositol. Thiamine- and inositol-amended media inhibited growth of three basidiospore isolates, whereas a biotin-amended medium did not. After pre-culture on biotin plus thiamine and inositol media, the isolate used (isolate 23) was significantly less virulent than after pre-culture on the basal medium. Pre-culture on the biotin plus thiamine medium at 20°C. resulted in less virulence, followed by pre-culture on inositol medium at 30°C., and biotin plus thiamine medium at 30°C. Post-emergence damping-off was significantly greater following pre-culture of this isolate on the biotin plus thiamine medium.

To determine whether the lessened virulence of a basidiospore isolate was a result of genetic changes or whether it was a physiological change following pre-culture on the different vitamin-amended substrates, two single basidiospore isolates, progeny of basidiospore isolate 23, were compared with the parent and with each other. The parent isolate did not differ in total virulence when compared with the two progeny isolates after pre-culture on vitamin-amended basal media. Both parent and progeny were less virulent following pre-culture on the same media, but the vitamin treatment and the temperature which resulted in less virulence were different. Parent

and progeny differed significantly in total mycelium following pre-culture on vitamin-amended media but did not differ significantly in total post-emergence damping-off after pre-culture on the same media.

On the basis of the data, changes in virulence following pre-culture of single basidiospore isolates of P. filamentosa on vitamin-amended media are most likely the result of physiological rather than genetical changes.

59 pages. \$2.00. Mic 57-2324

A COMPARATIVE STUDY OF THE EPIDERMIS OF
 THE ORYZEAE, ZIZANIEAE, ZOYSIEAE,
 AND MAYDEAE

(Publication No. 21,540)

Elmer George Worthley, Ph.D.
 University of Maryland, 1957

Supervisor: Associate Professor Robert D. Rappleye

Epidermal cell types in four grass tribes were investigated. A total of 37 genera and 122 species were studied in the tribes Oryzeae, Zizanieae, Zoysieae and Maydeae.

Two new cell types were discovered during the present study: The genus Pharus has unusual hooked trichomes on the lower leaf blade, lemma, palea and axes of the inflorescence while the genus Hygroryza has irregular, punctate fundamental cells very unlike the oblong or square aspect of most fundamental elements. The epidermal elements of the Zizanieae were found to be similar to those of the Oryzeae. Strongly papillose fundamental cells were characteristic of both tribes. Panicoid bicellular hairs, membranous ligules, thin walled fundamental cells on the adaxial sheath surface, and bulliform cells on the upper blade surface were common cell types in these tribes. Chikusichloa, Streptochaeta, Lygeum, Hygroryza and Pharus are the only genera in the Oryzeae or Zizanieae without papillose elements. The last two genera have unique cell types as described above among known Gramineae. Unusual unipapillate fundamental cells are abundant in Lygeum epidermis.

The Zoysieae have highly varied epidermal structures. This tribe has both panicoid and festucoid bicellular hairs; ligules composed of hair or membranous ligules; smooth, unipapillate or strongly papillate fundamental cells; terete or flattened hairs; hooked or straight, cushioned trichomes and bulliform cells on the upper epidermis. The presence of contrasting epidermal elements together with the absence of consistent fundamental cell types throughout the tribe indicate the present artificiality of this taxon.

The Maydeae are characterized by very uniform cell types. Cushion and panicoid bicellular hairs, membranous ligules, wavy walled fundamental cells and bulliform epidermal elements on the upper leaf blade are common throughout the tribe. 83 pages. \$2.00. Mic 57-2325

CHEMISTRY

CHEMISTRY, BIOLOGICAL

STUDY OF UROPORPHYRIN METABOLISM WITH SPECIAL REFERENCE TO CONDITIONS OTHER THAN PORPHYRIA

(Publication No. 21,238)

Fouad Anis Bashour, Ph.D.
University of Minnesota, 1957

The studies reported in this thesis dealt primarily with the role of reduced uroporphyrin (uroporphyrinogen) and reduced coproporphyrin (coproporphyrinogen) as intermediates in the biological synthesis of protoporphyrin, and with the excretion of uroporphyrin in conditions other than porphyria, especially in individuals with lead exposure and liver disease.

Both C¹⁴ and N¹⁵ labelled uroporphyrins and coproporphyrins were prepared from excreta of subjects given glycine -2-C¹⁴ or glycine N¹⁵. The porphyrins were converted to their chromogens by means of sodium amalgam reduction, and incubated with dog liver homogenate or with hemolyzed chicken red blood cells. The uroporphyrinogen C¹⁴ (mainly type III) was converted in both systems to coproporphyrin C¹⁴ and to protoporphyrin 9 C¹⁴, while incubation with coproporphyrinogen III C¹⁴ yielded protoporphyrin 9 C¹⁴. The conversion of uroporphyrinogen I N¹⁵ to coproporphyrinogen I N¹⁵ was demonstrated in dog liver homogenate. No definite conclusions could be reached regarding the possible conversion of reduced coproporphyrinogen I N¹⁵ to the type I protoporphyrin in these systems. The reduced uroporphyrin and coproporphyrin isomers I and III are, therefore, the metabolically active intermediates in the progressive decarboxylation of uroporphyrin to protoporphyrin.

Per diem values of up to 37 micrograms of uroporphyrin were found in normal urine. A uro-type prophyrin was also demonstrated in feces of normal subjects, the upper limit of normal being 60 micrograms per day. Decreased fecal values were found in patients with complete biliary obstruction.

The blood and urine porphyrin concentrations were determined in 57 workers exposed to lead in two separate plants. A moderate increase in the urinary excretion of uroporphyrin was found, together with an approximately tenfold increase in the urinary coproporphyrin and erythrocyte protoporphyrin levels. The crystallized uroporphyrin methyl ester was characterized as the type I isomer. Porphobilinogen was found in the urine of each of 13 workers studied. Fecal porphyrin levels were found to be normal in seven individuals with clinical lead poisoning despite the presence of elevated urinary values. Urinary coproporphyrin and uroporphyrin values declined rapidly following administration of calcium versenate to human and animal subjects. A detailed statistical study was carried out of the different tests employed for evaluation of lead poisoning. A significant negative correlation was found between the hemoglobin level in these workers and

the level of urinary coproporphyrin. Based upon these findings and those of other investigators, a mechanism was discussed for the action of lead in hemoglobin metabolism.

An increased urinary excretion of uroporphyrin was found in certain patients with liver disease. No definite correlation was observed between its level and the clinical status of the patient. However, a decrease in uroporphyrin excretion was noted concomitant with clinical improvement. The uroporphyrin isolated from the urines of patients with alcoholic liver cirrhosis and postnecrotic liver cirrhosis behaved predominantly like the type I isomer. A Waldenström-type uroporphyrin was isolated from the feces of a patient with alcoholic liver cirrhosis. The significance of this increased uroporphyrin excretion in patients with liver disease could not be determined. Two possible mechanisms were suggested: first, an overproduction of porphyrin by the diseased liver, and second, a decreased elimination by the liver into the bile.

223 pages. \$2.90. Mic 57-2326

THE INVESTIGATION OF CERTAIN ANTIBACTERIALS IN POPULUS TACAMAHACA MILL. AND HYPERICUM PROLIFICUM

(Publication No. 21,055)

Gerald Gean Dull, Ph.D.
Michigan State University, 1956

Two sesquiterpene alcohols, one of which was identified as an isomer of bisabolol, were isolated from the buds of Populus tacamahaca Mill. by means of solvent extraction, fractional distillation and chromatographic techniques. Both substances showed in vitro activity against Mycobacterium tuberculosis at the level of five micrograms per milliliter.

An ethyl acetate extract of the flowers of H. prolificum yielded, after purification by adsorption chromatography, a highly antibacterial substance. The structure of this principle has not been established as yet but the substance has been shown to contain an aromatic nucleus, a hydroxyl group and a carbonyl group. The absence of nitrogen, sulfur and halogens has been established and it appears that the molecule is composed of only carbon, hydrogen and oxygen.

82 pages. \$2.00. Mic 57-2327

A STUDY OF THE PURIFICATION,
PROPERTIES, AND MECHANISM OF
ACTION OF THE ENZYME DEXTRANSUCRASE

(Publication No. 21,473)

Willis Egbert Haines, Ph.D.
The Ohio State University, 1957

Dextran is a polysaccharide produced by bacteria of the genus Leuconostoc when grown on a sucrose medium. It is used predominantly as a blood plasma expander in those cases where plasma is not available in sufficient quantities and it is desirable to prevent shock by maintaining the blood volume.

To be acceptable clinically, it must be free of impurities which might cause undesirable reactions, and it must be of the proper molecular weight. Since the native dextran, as usually produced by the bacteria, is of high molecular weight, it must be depolymerized to reduce the molecular weight and then fractionated to secure the desired size range.

It would be more economical to produce this low molecular weight product directly; such syntheses have been tempted by other workers by enzymatic means.

In order to predict the probable conditions which might lead to the desired product, it is necessary to study the way in which the enzyme acts and the reactions which are involved. Such a study is facilitated by obtaining the enzyme in a pure form.

Attempts at increasing the purity of the enzyme to a greater degree than that achieved by other workers were not successful. Adsorption and precipitation characteristics of the enzyme were studied which may give some guidance to further purification procedures.

Enzyme kinetics were studied with the enzyme preparation by the new turbidimetric assay procedure which determines dextran by precipitation with 90 per cent ethyl alcohol. The method eliminates errors inherent in the reducing sugar methods, which assume that the only reducing sugar produced in dextran synthesis is the by-product, fructose.

As a result of the kinetic studies, it was found that maltose inhibited the reaction at low sucrose concentrations, as did other additives. This inhibitory effect was reduced at higher sucrose concentrations. In no case was there an increase in reaction velocity, as is true when determinations are made by the reducing sugar method. Determinations of the Michaelis-Menten constant showed that it was independent of temperature and of enzyme concentration. Hydrogen ion and temperature effects on the velocity were observed, and the activation energy was calculated to be 16 kcal. per mole.

From observed phenomena of dextran synthesis and from kinetic data, a mechanism was formulated for the enzyme action. It postulates a formation of a double complex, which then forms a triple complex with an acceptor molecule which may be (1) another sucrose molecule, (2) a low molecular weight dextran molecule, or (3) a high molecular weight dextran molecule. If either of the first two reactions predominates, the product will tend to be lower molecular weight. If the last reaction predominates, the molecular size will be larger.

The mechanism explains many of the observed characteristics of the bacterial fermentation and the enzymatic synthesis. It agrees with the kinetic data, although the data does not definitely establish the mechanism.

From the proposed theory, it is possible to make certain generalizations as to the conditions which would be most favorable in searching for the right combination of variables to yield a clinically suitable low molecular weight dextran.

154 pages. \$2.05. Mic 57-2328

THE BIOCHEMISTRY OF 5'-NUCLEOTIDES

(Publication No. 20,251)

Nan-Sing Ling, Ph.D.
The University of Wisconsin, 1957

Supervisor: Associate Professor Robert M. Bock

Various available methods were surveyed for the assay of myokinase activity. A sensitive and quantitative method involving another enzyme PGAKinase was found suitable for the determination of ATP. The system is very specific for ATP. The ferric hydroxamate complex of 3-PGA formed in the PGAKinase-PGA-Mg system with HONH_2 was measured colorimetrically at 490 μm . This method was employed to study myokinase purification, myokinase kinetics, and PGAKinase kinetics.

The applicability of ion-exchange chromatography employing Amberlite IRC-50 resin in the purification of myokinase has been tested. The gradient elution technique using a mixer system describing a linear concentration gradient gave high resolution with simplified manipulation. Twelve different proteins were well separated by the resin and only four proteins demonstrated myokinase activity. The four distinct myokinases were named α , β , γ and δ in the order in which they appear in the chromatographic pattern.

Two pH optima were demonstrated by both the β and crystalline myokinase samples. Possible explanations of the pH behavior of myokinase in terms of enzyme denaturation, of enzyme ionizations, and of substrate ionizations are discussed. The pH optimum and HONH_2 buffer concentration for best results in the PGAKinase assay for ATP were determined.

A highly active PGAKinase enzyme has been prepared from "Alaska" peas. One hundred and twenty-nine fold purification from the crude extract has been achieved. The various factors that affect the assay system for PGAKinase and the color development conditions have been studied. The concentrations of FeCl_3 , TCA and HCl were selected for color development giving minimum variations in absorbancy at 490 μm .

The apparent stability constant for an ionic complex of 3-PGA^{-3} with Mg^{++} has been studied both titrimetrically and spectrophotometrically. Mathematical treatments of the data are presented for the two methods. A discrepancy exists in the values obtained by the two methods. The dissociation constant determined titrimetrically is 0.014 M. A low dissociation constant (3mM) is obtained by the spectrophotometric method. The values of the dissociation constants obtained titrimetrically for MgPGA^{-1} and for MgATP^{-2} of 0.014 and of 0.0003 M respectively are used in the estimation of free ionic species of the substrates in the PGAKinase-3-PGA-Mg system.

The kinetics of the Mg^{++} activation of PGAKinase has been studied with experiments designed to map the kinetics over wide concentration ranges of various ionic species of

the substrates. Since 3-PGA, ATP and $MgCl_2$ form an interacting system, the change in reaction velocity upon variation of one of these cannot be studied while simply holding the concentration of the other two reactants constant. Attempts were made to select those conditions where one ionic form could be considered the key variable. Inhibition by ATP^{-4} under the conditions of simultaneously high concentrations of ATP^{-4} (<5 mM) and low concentrations of Mg^{++} ($<.02$ mM), by high concentrations of PGA^{-3} and by high concentrations of Mg^{++} was observed. No one mechanism proposed by Alberti for effects of coenzyme concentration is sufficient to describe the kinetic behavior of PGAKinase. His mechanisms B-1, B-2 and B-3 are eliminated by the fact that the experimental results are incompatible with the mechanisms.

The physical properties of the 5'-nucleotides such as the ultraviolet absorption spectra, state of hydration and ionization constants have been determined during the course of the research covered by this thesis.

136 pages. \$2.00. Mic 57-2329

A STUDY ON THE ESTEROLYTIC PROPERTIES OF PROTEINASES: ACTION OF PAPAIN, TRYPSIN, AND CHYMOTRYPSIN (PARTS I AND II)

(Publication No. 21,296)

Clarence Eugene McDonald, Ph.D.
Purdue University, 1957

Major Professor: A. K. Balls

Specificity Studies

(Hydrolysis of Various Nitrobenzoyl-L-Arginine Esters by Papain and Trypsin.)

Specificity studies have been carried on with a group of esters split by both papain and trypsin. The old opinion that these enzymes were very much alike has been amply confirmed by a study of the esters they split; at the same time outstanding differences in the behavior of papain and trypsin have been discovered.

When papain was allowed to act on α -N-benzoyl-, α -N- o -nitrobenzoyl-, α -N- m -nitrobenzoyl-, and α -N- p -nitrobenzoyl-L-arginine methyl esters it was observed (from k_3 values) that the addition of a nitro group to any one of the three positions increased the rate of breakdown of the respective enzyme-substrate complex, and to about the same extent. However, in the case of these nitro esters, there was a difference in the ease of formation of enzyme-substrate complexes (indicated by k_1 and K_m values). The o -nitro ester complex forms much more readily than do the complexes of the para and meta nitro esters (the latter two form with about equal ease).

The effect of the introduction of nitro groups on the breakdown of the corresponding trypsin-ester complexes (shown by k_3 values) is very different from that observed with papain. In the ortho position a nitro group increases the rate (as with papain) but in the other two positions the rate is decreased. Moreover, in the case of the meta

ester, the addition of a second nitro group to the remaining meta position (forming 3,5-dinitrobenzoyl arginine ester) restores the activity.

Thus the esters used here have shown a clear distinction of specificity between papain and trypsin when only the position of a single nitro group on an aromatic nucleus is varied.

Studies on the Mode of Action of Chymotrypsin

(Reaction of Chymotrypsin with p Nitrophenyl Esters and Study of the Resulting Intermediates, which are Acylated Chymotrypsins.)

Recently, the reaction of chymotrypsin with a particular ester, nitrophenyl acetate, has been extensively used in studying the mechanism of chymotryptic catalysis. It has been demonstrated that an acetyl chymotrypsin is formed as an intermediate during the process. This protein contains one loosely bound acetyl group per molecule. In the presence of many alcohols, however, the acetyl group is transferred to the alcohol, forming the corresponding ester. The enzyme exhibits a marked preference for certain types of alcohols. In a series concluding with n-hexyl alcohol, the rate of transfer increases with the length of the straight carbon chain. One exception is methanol, which reacts faster than ethanol. When the chain is branched, the rate of transfer is much slower. Thus, iso-propanol and sec.-butanol react slowly in comparison to n-butanol, while tert-butanol is almost inert. The primary alcohols also inhibit the liberation of tyrosine from tyrosine ethyl ester by chymotrypsin. This, in part at least, is also a transfer reaction, as shown by the isolation of n-butyl tyrosine from a system consisting of tyrosine ethyl ester, n-butanol, and chymotrypsin. Alcohols have therefore been regarded as inhibitors of chymotrypsin, but in reality the enzyme is not greatly inhibited. Instead it catalyzing a different reaction.

Chymotrypsin also reacts with other p-nitrophenyl esters. In this manner chymotrypsin was acylated with isobutyric and trimethylacetic acids, acids whose carbonyl carbons are more sterically hindered than that in acetic acid. Like acetyl chymotrypsin, these intermediates are devoid of enzymic activity until they are deacylated.

As was to be expected, acetyl chymotrypsin is activated or deacylated much more readily than trimethylacetyl chymotrypsin, whereas isobutyryl chymotrypsin is intermediate reactive. All three intermediates were deacylated faster at higher pH levels. Trimethylacetyl chymotrypsin was further studied after its isolation (as a lyophilized material). It gave practically no hydroxamic acid test, even at a high pH (in great contrast to acetyl chymotrypsin). The preparation was almost inactive toward L-tyrosine ethyl ester and in milk-clotting tests. The trimethylacetyl group could, however, be removed for the inactive material became almost as active as the original chymotrypsin on standing in phosphate buffer (pH 8.0) containing 30 per cent glycerol.

The similarity between the more stable acyl chymotrypsins and the phosphorylated esterases (such as phosphorylated chymotrypsin, choline esterase, etc.) is discussed at some length. The latter are formed by the action of toxic phosphate-esters now widely used as insecticides.

100 pages. \$2.00. Mic 57-2330

D-ERYTHROSE 2-PHOSPHATE: ITS FORMATION FROM D-RIBOSE 3-PHOSPHATE, ISOLATION, AND PERIODATE OXIDATION

(Publication No. 21,575)

Lloyd Kent Moss, Ph.D.
Stanford University, 1957

D-Ribose 3-phosphate was oxidized for 15 minutes with sodium periodate at pH 5.75 and 0° to an O-formyl derivative of erythrose 2-phosphate. The formyl group was removed by mild hydrolysis, and the reaction mixture was separated on a Dowex 2 (bicarbonate) ion exchange column. Since the qualitative and quantitative aspects of the reaction had been studied by Levy [Ph.D. Dissertation, Stanford University, 1956], the objective became the performance of the reaction on a scale large enough to permit isolation of the tetrose phosphate as a salt. Crystalline monobrucine and dibrucine salts of erythrose 2-phosphate, m.p. 131°-135° dec. and 111°-113° dec., resp., were prepared by concentration of the free acid adjusted to pH 4.6 and 7.1 with brucine. The ribose 3-phosphate used was a crystalline dibrucine salt prepared in this laboratory by Wm. F. Hain according to the procedure of Khym, Doherty and Cohn [J. Am. Chem. Soc., 76, 5523 (1954)], $[\alpha]_D^{25} -28^\circ$, in contrast to that of -35° reported by the authors mentioned.

The structure of erythrose 2-phosphate was established by oxidation with periodate at pH 5.75 and 0° to tartronaldehyde phosphate, a hypothetical intermediate compound which apparently readily isomerized to reductone phosphate [Levy, *op. cit.*], and formaldehyde, liberated in 1:1 ratio. An ultraviolet spectrophotometric procedure for following the course of the reaction at room temperature was devised. Periodate oxidation of D-erythritol 2-phosphate, produced by sodium borohydride reduction of erythrose 2-phosphate, gave formaldehyde but no reductone phosphate. It was also found possible to measure the slow conversion of tartronaldehyde phosphate to reductone phosphate by titration with iodine at 0°.

A procedure for the quantitative estimation of erythrose was developed, based upon the use of the orcinol reagent of Drury [Arch. Biochem., 19, 455 (1948)], λ_{max} 430 m μ , ϵ 21,700. Crystalline di-O-formyl erythrose, m.p. 62-64°, $[\alpha]_D^{25} -18.5^\circ$ (c 3, H₂O), prepared by lead tetraacetate oxidation of glucose according to Perlin and Brice [Can. J. Chem., 33, 1216 (1955); 34, 541 (1956)], was used as a standard.

During the preliminary study of the low temperature periodate oxidation of ribose 3-phosphate, it was noted that a considerable amount of ribose phosphate remained unoxidized after the completion of the initial oxidation reaction. From a consideration of the various possible structural isomers of ribose 3-phosphate that might be present, it seemed logical to conclude that only the α -compounds, e.g., α -D-ribopyranoside 3-phosphate and α -D-ribofuranoside 3-phosphate, and acyclic ribose 3-phosphate were oxidized under the conditions mentioned. A chemical method for the determination of absolute anomeric configuration based upon this observation was proposed and tested on several sugars, e.g., α - and β -glucose, maltose, lactose, fructose and L-sorbose. It was established that the configuration of the hydroxyl on the anomeric carbon atom of sugars greatly influences the rate of periodate oxidation in neutral aqueous solution at 0°.

The periodate oxidation of seminal acid phosphatase was studied in order to characterize this enzyme which was used to dephosphorylate the sugar phosphates. A significant reduction of periodate with moderate liberation of formaldehyde was found for this protein. An attempted oxidation of insulin by periodate was discussed.

136 pages. \$2.00. Mic 57-2331

STUDIES ON SULFUR COMPOUNDS FROM ONION

(Publication No. 21,309)

Harold Edward Renis, Ph.D.
Purdue University, 1957

Major Professor: Robert E. Henze

In this investigation, the sulfur compounds of onion (*Allium cepa* L.) were studied with particular interest in those non-volatile compounds which may serve as precursors to the volatile sulfur compounds. The odor and lachrymatory activity of the onion is generally attributed to volatile sulfur compounds produced when the onion tissue is injured. It has been observed, also, that injury to the bulb causes an increase in pyruvic acid content. The possible connection between these facts has not been elucidated.

A cation fraction obtained by ion exchange fractionation of a boiling water extract of mature onion bulbs revealed, by a paper chromatographic comparison with synthetic cysteine derivatives, the presence of two cysteine derivatives not previously reported in nature. On the basis of chromatographic behavior in at least six solvent systems these new compounds obtained from mature onion bulbs were shown to be identical with desoxy-alliine (S-allyl-cysteine) and dihydroalliine (S-propyl-cysteine-sulfoxide). Alliine, the prominent sulfur compound of garlic bulbs, was found to be absent in the onions used in this study.

Attempts to purify the enzyme responsible for the pyruvic acid production in damaged onion bulbs were unsuccessful although active crude extracts could be prepared. The enzyme alliinase, isolated from garlic bulbs, was found to have considerable activity in producing pyruvic acid when acting on an onion substrate.

Radioautographs of chromatograms prepared from extracts of onion seedlings maintained on nutrient solutions containing sulfate (S³⁵) revealed the presence of more than 20 radioactive sulfur containing compounds. A comparison of radioautographs of young onion extracts obtained after inactivating enzymes in boiling water with radioautographs of extracts prepared under conditions favorable to the production of volatile sulfur compounds showed a decrease in radioactivity of at least three compounds suggesting their possible participation in the production of volatile sulfur compounds. Paper chromatography of the extracts of young onions failed to show the presence of alliine (S-allyl-cysteine-sulfoxide), desoxy-alliine (S-allyl-cysteine), dihydro-alliine (S-propyl-cysteine-sulfoxide) and S-propyl-cysteine, in contrast to extracts of mature onion bulbs in which desoxy-alliine (S-allyl-cysteine) and dihydro-alliine (S-propyl-cysteine-sulfoxide) were found present. Ion-exchange fractionation of the radioactive extracts indicated that one of the compounds

disappearing on enzyme action was present in the anion and neutral fraction while the other compounds were present in the cation fraction. The major compound involved in volatile sulfur production on the basis of radioactivity measurements, although found in the cation fraction, did not react with ninhydrin or nitrous acid and could not be oxidized or reduced with cysteine or sodium metabisulfite. Free cysteine, methionine, lanthionine, cystathionine or glutathione were not detected in the extracts. Methionine-methylsulfonium salt and methionine sulfone were, however, chromatographically identified in the radioactive extracts of young onion tissue.

130 pages. \$2.00. Mic 57-2332

ACID SOLUBLE AND METALLIC COMPONENTS OF THE TOBACCO MOSAIC VIRUS

(Publication No. 21,586)

Richard Stefen Waritz, Ph.D.
Stanford University, 1957

The acid soluble fraction of tobacco mosaic virus reported by Cooper and Loring (1) was investigated in further detail. It was separated into three ultraviolet absorbing fractions by two dimensional paper chromatography with two solvent systems. The ultraviolet absorbing areas on the chromatograms were eluted and their absorption spectra determined. The effect of acid hydrolysis on the fraction was studied in the same way. The evidence obtained in this way indicated that this acid soluble fraction contained adenine and cytidylic acid. No evidence was found to indicate the presence of amino acids in this fraction, or of phospholipids in the virus.

Evidence was found which indicated the presence of metallic components in the tobacco mosaic virus. Emission spectra of ashed virus samples showed the presence of small amounts of iron, copper, calcium and magnesium, and quantitative colorimetric analyses were performed to determine the amounts present. Analyses of the virus for these four metals, after it had been dialyzed against water or ethylenediaminetetraacetic acid (EDTA) at pH 7 for periods of one to seven days in the cold on a rocking dialyzer, showed that these treatments did not remove all of these four metals from the virus. However, all of the EDTA treatments did remove larger amounts of copper, calcium, and magnesium from the virus than did the corresponding water treatments, indicating varying virus-metal bond strengths. The iron content of the virus was unaltered by any of the treatments tried. After dialysis against EDTA for seven days, there still remained 20, 3, 52, and 45 atoms of iron, copper, calcium, and magnesium, respectively, per virus particle.

Yeast ribonucleic acid also contained appreciable amounts of copper and calcium. Tobacco mosaic virus ribonucleic acid contained approximately twenty times as much iron and magnesium on a weight basis as did the intact virus. These results suggest that these components occur predominantly in the virus nucleic acid. Such a role for these two metals was further indicated by the facts that, (1) they were not completely removed from the nucleic acid by dialysis against EDTA, whereas the copper and calcium were, and (2) commercial yeast nucleic acid was found to contain iron and magnesium.

Possible roles for these metals in viruses, other nucleoproteins, and nucleic acids were suggested and further experiments to indicate these roles were outlined.

Reference

1. Cooper, W. D., and Loring, H. S., *J. Biol. Chem.*, 211, 505 (1954). 135 pages. \$2.00. Mic 57-2333

CHROMATOGRAPHIC SEPARATION AND IDENTIFICATION OF AMINO NITROGEN COMPOUNDS IN SOME OHIO SOILS

(Publication No. 20,737)

J Lowell Young, Ph.D.
The Ohio State University, 1956

The present information available regarding the nature of soil nitrogen complexes is unsatisfactory. Recently developed ion exchange and paper chromatographic techniques permit examination of these nitrogen complexes to a degree never before possible. In the study attempts were made to separate and identify the amino nitrogen compounds in the acid hydrolysates of several soils by these techniques.

The soil samples were: a virgin Hoytville Clay loam, a virgin Wooster Silt loam, and four long-time rotation Wooster Silt loams.

The procedure included the following:

- hydrolysis of the soil samples by autoclaving with 6 N hydrochloric acid for 18 hours at 121° C. and 15 pounds pressure;
- desalting of the acid hydrolysate by passing it through a H⁺ column of Dowex-50, 100-200 mesh resin;
- ion exchange chromatography of the desalted hydrolysate on a column of Dowex-50, 8-x, less-than-270 mesh, H⁺ saturated resin;
- colorimetric determination of concentration by a Troll and Cannan method;
- paper chromatographic identification using three solvent systems: butanol-acetic acid-water, phenol-water, collidine-lutidine-water; and three color reagents: ninhydrin, isatin, alloxan.

The approximate distribution of the soil nitrogen following hydrolysis was:

- one-fourth not released from the soil complex;
- one-third liberated as ammonia nitrogen;
- one-third liberated as alpha-amino nitrogen;
- one-tenth released in forms other than ammonia or alpha-amino nitrogen.

Representative elution diagrams of the ion exchange separations and color prints of some paper chromatograms are presented and discussed. At least fifty-seven peaks appeared on the elution diagrams of each soil hydrolysate. Two or more substances were present in several of these peaks as revealed by paper chromatography. The following 24 constituents were identified: cysteic acid, n-acetyl-glucosamine (?), glucosamine, aspartic acid, serine, threonine, glutamic acid, methionine sulfone, hydroxy-proline, glycine, alanine, beta-alanine, gamma-amino butyric acid, valine, methionine sulfoxide, proline, isoleucine, ornithine, leucine, lysine, histidine, tyrosine,

arginine, phenylalanine. Most of the remaining unidentified constituents appeared in very small amounts. Some are thought to be amino sugars. Others may be closely related to identified compounds.

The study has shown the presence of many common amino acids and a large number of previously unrecognized nitrogenous substances in acid soil hydrolysates. The practical significance of the presence of any or all of the indicated substances has yet to be determined. Improved methods and techniques will be required to distinguish between the compounds which occur naturally and those which are artifacts of present procedures.

102 pages. \$2.00. Mic 57-2334

CHEMISTRY, INORGANIC

THE STEREOCHEMISTRY OF COMPLEX INORGANIC COMPOUNDS: 1. THE CIS-DINITROETHYLENEDIAMINE-2,3-BUTYLENEDIAMINE COBALT (III) ION. 2. SOME COMPLEXES OF COBALT (III) WITH 2,2',2"-TRIAMINOTRIETHYLAMINE AND RELATED COMPOUNDS

(Publication No. 20,871)

Chui Fan Liu, Ph.D.
University of Illinois, 1957

Part 1

In 1918 Werner reported the separation of all of the eight possible isomers of cis-dinitroethylenediaminepropylenediamine cobalt (III) ion. The isomerism of this ion is due to the asymmetry of the octahedral cobalt, the asymmetry of the propylenediamine, and the unsymmetrical location of the methyl group on the propylenediamine. The problem may be simplified, and the stereochemistry better understood by eliminating one of these factors.

The present investigation was concerned with the stereoisomerism of the cis-dinitroethylenediamine-2,3-butylenediamine cobalt (III) ion. The isomerism of this ion is due to the asymmetry of the octahedral cobalt and the asymmetry of the 2,3-butylenediamine.

The cis-dinitroethylenediamine-2,3-butylenediamine cobalt (III) ion was prepared according to the following scheme:



The cis and trans isomers of $[\text{Co en bn } (\text{NO}_2)_2]^+$ had very different solubility properties and were very easily separated. The resolution of the cis isomer into its four optical isomers was accomplished by fractional crystallization of the d- α -bromocamphor- π -sulfonate salt. The rotatory dispersion curves of the four isomers as the bromide were determined to show that they were two dl pairs. It was also found that one dl pair were more stable toward racemization and hydrolysis than the other dl pair.

Part 2

Complexes of cobalt (III) containing one molecule of 2,2',2"-triaminotriethylamine have certain desirable properties. They are chemically and thermally stable. They maintain a cis configuration throughout reactions. They are symmetrical compounds. Their structures are such that back side attacks are unlikely in substitution reactions. The combination of these properties makes complexes of this type very desirable in stereochemical and mechanistic studies.

The present investigation was carried out to devise a convenient method of synthesis of these cobalt (III) complexes and to determine their structures. Unlike other cobalt (II) amine complexes the complex of cobalt (II) and triaminotriethylamine resisted oxidation to cobalt (III). However, when the carbonatotetrammine cobalt (III) ion was treated with triaminotriethylamine, then with concentrated hydrochloric acid, the dichlorotriaminotriethylamine cobalt (III) ion was obtained. By using the dichloro complex as starting material other complexes with the same structure were prepared. Among these were dithiocyanotriaminotriethylamine cobalt (III) thiocyanate, chloroamminetriethylamine cobalt (III) chloride, and ethylenediaminetriaminotriethylamine cobalt (III) chloride. Using the same method 1,3-diamino-2-propanoltriaminotriethylamine cobalt (III) bromide was prepared, and this compound was resolved into its optical isomer by fractional precipitation of the antimonytartrate salt. It was found that the +9 ion $[\text{Co}_3 \text{ en}_6 \text{ tren}_2]^{+9}$ postulated by Jaeger was identical with $[\text{Co en tren}]^{+3}$ prepared in this investigation.

Tris-(salicylideneamino)-triethylamine was prepared by treating triaminotriethylamine with salicylaldehyde. This Schiff's base formed a one to one cobalt (III) complex which was a non-electrolyte. This inner complex seemed to have a free tertiary amine group.

74 pages. \$2.00. Mic 57-2335

STUDIES IN THE SYNTHESIS OF THE PHOSPHINAMIDES RELATED COMPOUNDS

(Publication No. 21,452)

Adib Jabbur Sarkis, Ph.D.
The Ohio State University, 1956

The purpose of the research is (1) to investigate the reaction of chloramine with monoalkyl phosphines and find out whether it produces phosphinamides according to the following equation:



and (2) to investigate the reaction of chloramine with triphenyl phosphine and study the products formed.

This problem was suggested because of the belief that chloramine might form products with the above phosphines similar to the hydrazines and hydrazinium salts which it forms with primary, secondary, and tertiary amines.

The reactions between monoalkyl phosphines and chloramine were studied in liquid ammonia (at -33.4°C) while those which involved triphenyl phosphine and similar

compounds were carried on in ether solutions (at or near the freezing point of water).

The newly prepared compounds were identified by quantitative analysis. A characteristic infrared spectrum was obtained for each of them.

Monoalkyl phosphines and chloramine did not seem to form compounds having the P-N bond. However, a substance with strong reducing properties (probably a polymer) was formed when sodium phosphine and triphenyl methane chloride (dissolved in ether) were mixed together in liquid ammonia.

A reaction was established between triphenyl phosphine and chloramine by isolating the product, triphenyl amino phosphonium chloride, $[(C_6H_5)_3P-NH_2]^+Cl^-$, and by preparing the following seven derivatives of the triphenyl amino phosphonium ion: hexafluorophosphate, perchlorate, anthraquinone b-sulfonate, nitro prusside, periodate, hexachlorplatinate, and picrate.

Triphenyl phosphine also reacted with methyl chloramine and although triphenyl methyl amino phosphonium chloride was not isolated, yet its existence was evidenced by preparing the following four triphenyl methyl amino phosphonium derivatives: hexafluorophosphate, perchlorate, picrate, and hexachlorplatinate. The infrared spectra of all these new compounds were determined.

A brief study of the apparent behavior of triphenyl compounds of other members of group V B with chloramine and some of its derivatives was also made.

87 pages. \$2.00. Mic 57-2336

REDUCTIVE ACETYLATION WITH LITHIUM ALUMINUM HYDRIDE AND ACETIC ANHYDRIDE AND THE SYNTHESIS OF A SATURATED ALL-CIS POLYMER

(Publication No. 21,537)

Mark Joseph Stanek, Ph.D.
University of Maryland, 1957

Supervisor: Professor William J. Bailey

The difficulties involved in the isolation of water soluble compounds from lithium aluminum hydride reduction posed a serious limitation on the use of this reagent for the reduction of polyfunctional compounds. Part of the work reported here gives a satisfactory general method for the isolation of water soluble compounds via their acetyl derivatives.

The alcoholate complexes which result from the reduction are decomposed by the addition of glacial acetic acid and the liberated glycols, which are not isolated, are acetylated directly with acetic anhydride. The inorganic salts produced are removed by filtration and the acetyl derivatives are isolated from the filtrate. The following polyacetates have been prepared successfully by this procedure: L(-)-tetraacetylthreitol (69%), hexahydrophthalyl diacetate (94%), 1,4-diacetoxypentane (98%), 1-acetoxy-3-(N,N-diacetylamino)-propane (47%) and 1,4-diacetoxylthiobutane (33%).

If the unacetylated derivative is desired, it can be obtained by means of a simple ester interchange. For example, L(+)-threitol was obtained in 85% yield from L(-)-tetraacetylthreitol by this procedure.

The second part of this thesis describes the preparation of a saturated all-cis polymer, perhydro-poly-1,2-dimethylenecyclohexane, by the hydrogenation of poly-1,2-dimethylenecyclohexane. In the hydrogenated polymer, the cyclohexane rings are used in place of double bonds to attain the necessary orientation. It was hoped that by hydrogenation the over-all symmetry of poly-1,2-dimethylenecyclohexane would be greatly reduced to produce a substantially decreased softening point.

Perhydro-poly-1,2-dimethylenecyclohexane was prepared in 95% yield by the catalytic hydrogenation of poly-1,2-dimethylenecyclohexane with decalin as the solvent and reduced nickel on kieselguhr as the catalyst. If the hydrogenation was conducted at 200° and 3000 p.s.i. pressure of hydrogen, a transparent amorphous material was obtained. Subsequent reprecipitation of this material gave a white powder which had a softening point of 110° as compared with 165° for poly-1,2-dimethylenecyclohexane. Other hydrogenated polymers which are less than 100% saturated were also prepared and their softening points were determined. In every case, the partially hydrogenated polymers melted below the softening point of perhydro-poly-1,2-dimethylenecyclohexane.

The partially hydrogenated polymer which contained 33% residual unsaturation appeared to possess a certain degree of elasticity and a sample of this material will be vulcanized to evaluate its rubbery properties.

The residual unsaturation was determined by reaction of a benzene solution of the polymer with perbenzoic acid followed by a determination of the decrease in perbenzoic acid content of the solution. Viscosity measurements on the starting material and the product indicated that little if any degradation of the polymer chains had occurred during the hydrogenation. Infrared analyses also indicated the absence of unsaturation in perhydro-poly-1,2-dimethylenecyclohexane.

During the course of the previous work, a dimer of 1,2-dimethylenecyclohexane was isolated. Infrared analysis, hydrogenation, elemental analysis, boiling point and perbenzoic acid analysis indicated that the dimer was spiro-[2-methylenecyclohexane-1,2'- Δ^9 (1 α)-octahydronaphthalene], which results from a normal Diels-Alder reaction between two molecules of the diene.

98 pages. \$2.00. Mic 57-2337

CHEMISTRY, ORGANIC

THE TOTAL SYNTHESIS OF dl-RICINOLEIC ACID AND THE PYROLYSIS OF METHYL dl-12-METHYLRICINOLEATE

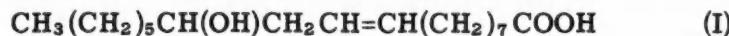
(Publication No. 21,542)

Carolyn Burger Abrahams, Ph.D.
Boston University Graduate School, 1957

Major Professor: Walter J. Gensler

Part I

Ricinoleic acid, which in the form of its triglyceride is the major component of castor oil, was shown by Goldsobel in 1894 to be 12-hydroxyoctadec-9-enoic acid (I), from degradation studies.



This structure was accepted with some reservations, because it does not easily accommodate all of the observed chemistry of ricinoleic acid. A rational synthesis of I was undertaken and successfully completed. The synthetic acid was shown to be dl-ricinoleic acid, thus proving unambiguously that the above formulation is correct.

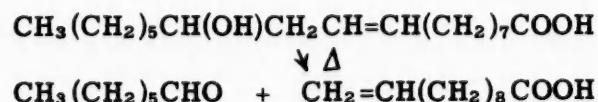
Two alternate preparations were reported during the course of this synthesis, which also verify structure I; however sixty years elapsed before dl-ricinoleic acid was prepared by total synthesis. The reason for this was the difficulty in constructing a β -hydroxy olefin system in the eighteen carbon chain. In recent years advances in acetylene chemistry have made alkyne intermediates invaluable in the elaboration of long chain unsaturated compounds. In the present synthesis a 1-alkyne was condensed with a suitable epoxide, establishing a β -hydroxy acetylenic system. Partial reduction of the ethynyl linkage afforded the corresponding β -hydroxy olefin.

The 1-alkyne employed in this preparation was 9-chlorononyne-1 and was prepared from pimelic acid according to the following outline. Pimelic acid was reduced to 1,7-dihydroxyheptane using lithium aluminum hydride. Treatment of the diol with excess thionyl chloride yielded 1,7-dichlorheptane. 1-Chloro-7-iodoheptane was prepared by refluxing an equimolar amount of sodium iodide with 1,7-dichlorheptane in acetone. Treatment of the 1-chloro-7-iodoheptane with sodium acetylide in liquid ammonia yielded 9-chlorononyne-1.

1,2-Epoxyoctane was prepared by epoxidation of 1-octene using either perbenzoic acid or trifluoroperacetic acid, as the oxidizing agent. Condensation of 1,2-epoxyoctane within the lithium derivative of 9-chlorononyne-1 yielded dl-1-chloro-11-hydroxyheptadecyne-8. Exchange of the chlorine for iodine and treatment with potassium cyanide afforded dl-1-cyano-11-hydroxyhept-decyne-8, which was hydrolyzed to dl-ricinoleic acid (12-hydroxyoctadec-9-ynoic acid). Semi-reduction of the triple bond using a palladium catalyst, which had been intentionally poisoned by lead acetate and quinoline, gave dl-ricinoleic acid. Purification of the final product by chromatography over decolorizing charcoal supported on diatomaceous earth yielded an acid, which exhibited the same properties as natural d-ricinoleic acid.

Part II

For ninety years it has been known that pyrolysis of ricinoleic acid yields heptaldehyde and 10-undecylenic acid.



The mechanism, however, has remained obscure. The purpose of the present work is to initiate a study of the reaction path.

One mode of attack is to investigate the pyrolysis products of a series of compounds, which are structurally related to ricinoleic acid. In the present work, one such compound was prepared and pyrolyzed.

Methyl dl-12-methylricinoleate was prepared from 12-ketooleic acid. The acid was esterified using diazomethane

and the methyl 12-ketooleate on treatment with methylmagnesium bromide yielded the desired product, methyl dl-12-methylricinoleate.

Pyrolysis of the tertiary alcohol derivative of methyl ricinoleate yielded methyl undecylenate and 2-octanone, showing that the tertiary hydrogen joined to the carbon atom containing the alcoholic function (C-9) is not involved in the pyrolysis process. This was evident because degradation was accomplished when this hydrogen was replaced by a methyl group. 203 pages. \$2.65. Mic 57-2338

THE PYROLYSIS OF ESTERS MECHANISM OF 1,4-ELIMINATION AND SYNTHESIS OF ISOMERS OF AROMATIC HYDROCARBONS

(Publication No. 21,512)

Robert Barclay, Jr., Ph.D.
University of Maryland, 1957

Supervisor: Professor William J. Bailey

One objective of this work was to investigate the mechanism of 1,4-elimination of carboxylic acids in the pyrolysis of crotyl esters. In the literature it has been proposed that this 1,4-elimination occurs in a one-step process involving a quasi-eight-membered ring, or that it involves allylic rearrangement to a second ester capable of 1,2-elimination. The latter mechanism must be assumed in the case of such trans crotyl esters as 1-cyclohexenyl-methyl acetate, which has been shown to undergo 1,4-elimination. It was of interest to determine whether this mechanism could be demonstrated in the pyrolysis of cis crotyl esters, the structure of which favors direct 1,4-elimination. Pyrolysis of cis-1,4-diacetoxy-2-butene at 500° yielded 1-acetoxy-1,3-butadiene (26%), 1,2-diacetoxy-3-butene (20%), and 1,4-diacetoxy-2-butene (24% recovery). Pyrolysis of 1,2-diacetoxy-3-butene at 495° yielded 1-acetoxy-1,3-butadiene (29%), 1,2-diacetoxy-3-butene (14% recovery), and 1,4-diacetoxy-2-butene (6%). When cis-1,4-diacetoxy-2-butene was pyrolyzed at 495°, 77% of one molar equivalent of acetic acid was liberated, while pyrolysis of 1,2-diacetoxy-3-butene under identical conditions yielded 83% of one molar equivalent of acetic acid. Since 1,2-diacetoxy-3-butene was formed in substantial amount in the pyrolysis of cis-1,4-diacetoxy-2-butene and pyrolyzed more easily than the latter to yield a similar mixture of products, it was concluded that the mechanism of 1,4-elimination of acetic acid from cis-1,4-diacetoxy-2-butene involved rearrangement to 1,2-diacetoxy-3-butene, followed by 1,2-elimination.

A second objective of this work was to investigate further the utility of ester pyrolysis in the preparation of compounds isomeric with aromatic substances. The synthesis of 5-methylene-1,3-cyclohexadiene was attempted by two routes, each starting with methyl 2-acetoxy-3-cyclohexenecarboxylate, prepared by the Diels-Alder reaction of 1-acetoxy-1,3-butadiene and methyl acrylate. Pyrolysis of this adduct at 420° yielded methyl 1,3-cyclohexadiene-1-carboxylate, which was reduced with lithium aluminum hydride to form a mixture of dienols. Acetylation of the latter yielded mainly 4-methylene-2-cyclohexenyl

acetate. Pyrolysis of this acetate at 450-455° afforded a complex mixture of products, of which toluene, 3-methyl-1-enecyclohexene and bibenzyl were identified. The most reasonable explanation for the formation of these products was that 4-methylene-2-cyclohexenyl acetate had dissociated into resonance-stabilized free radicals which gave rise to the observed products. It is to be expected that analogous free-radical reactions would occur in the pyroly-

ysis of other esters containing the group $-C=C-C=C-C-O\overset{\text{O}}{C}R$, since considerable resonance energy would be associated with the radicals from any such ester. In the second route, methyl 2-acetoxy-3-cyclohexenecarboxylate was reduced with lithium aluminum hydride to form an unsaturated glycol, acetylation of which yielded 2-acetoxy-3-cyclohexene-1-methyl acetate. Pyrolysis of this diacetate at 380° yielded a mixture of 4-methylene-2-cyclohexenyl acetate and other diene acetates, which could not be separated by distillation. Pyrolysis of the mixture of diene acetates at 460-465° produced a mixture of disproportionation products similar to that obtained from 4-methylene-2-cyclohexenyl acetate.

No simple conjugated triene readily capable of isomerization to an aromatic hydrocarbon is described in the literature. A compound of this class, 1,4-dimethylene-2-cyclohexene, was prepared from dimethyl terephthalate in an overall yield of 10%, the final step involving the pyrolysis of an ester. Catalytic hydrogenation of dimethyl terephthalate yielded dimethyl 1,4-cyclohexanedicarboxylate. The latter was converted to dimethyl 1-cyclohexene-1,4-dicarboxylate by partial saponification, monobromination, dehydrobromination and saponification, and re-esterification. Reduction of dimethyl 1-cyclohexene-1,4-dicarboxylate with lithium aluminum hydride yielded a crude glycol, acetylation of which gave 1-cyclohexene-1,4-dimethanol diacetate. This diacetate was pyrolyzed at 490-495° to yield 1,4-dimethylene-2-cyclohexene. The triene was shown to be pure by vapor-phase chromatography and infrared analysis, and its structure was proved by isomerization to *p*-xylene and ozonolysis to yield succinic acid and formaldehyde. The triene was resistant to polymerization with benzoyl peroxide as initiator. It was readily polymerized in the presence of boron fluoride even at -70°, but the polymer was insoluble in boiling phenyl ether.

146 pages. \$2.00. Mic 57-2339

PYROLYSIS STUDIES OF ESTERS, AMIDES AND LACTONES

(Publication No. 21,514)

Charles Norman Bird, Ph.D.
University of Maryland, 1957

Supervisor: Professor William J. Bailey

Since the pyrolysis of esters to produce the corresponding acids and olefins had been used successfully to synthesize a large variety of olefins, the application of this method to nitrogen derivatives was undertaken. *N*-(β -Acetoxyethyl)-*N*-ethylacetamide was pyrolyzed at 465° to yield the predicted products, *N*-ethyl-*N*-vinylacetamide and acetic acid.

The fact that at 490° *N*-(β -acetoxyethyl)-*N*-ethylacetamide pyrolyzed to yield vinyl acetate and *N*-ethylacetamide, indicated that an *N*-alkyl amide which possesses a β -hydrogen can pyrolyze to yield an amide and an olefin in a reaction analogous to ester pyrolysis. In an effort to learn the characteristics, scope and possible utility of this new reaction, the following amides were prepared and pyrolyzed: *N*-(1,1,3,3-tetramethylbutyl)-acetamide, *N*-(1,3-dimethylbutyl)-acetamide, *N*-(1,3-dimethylbutyl)-*N*-methylacetamide, *N*-(1,3-dimethylbutyl)-acetanilide and 1-acetylpyridine.

N-(1,3-Dimethylbutyl)-acetamide was found to be much more difficult to pyrolyze than the corresponding ester (methylisobutylcarbinyl acetate). The prediction that *N*-(1,3-dimethylbutyl)-acetanilide would pyrolyze more readily than *N*-(1,3-dimethylbutyl)-acetamide was born out; however, contrary to prediction, *N*-(1,3-dimethylbutyl)-*N*-methylacetamide also pyrolyzed somewhat more readily than *N*-(1,3-dimethylbutyl)-acetamide. The tertiary alkyl amide, *N*-(1,1,3,3-tetramethylbutyl)-acetamide, was found to pyrolyze much more readily than the secondary alkyl amides. This result agreed with the fact that tertiary esters are more readily pyrolyzed than secondary esters. At temperatures up to 600°, 1-acetylpyridine failed to yield the expected 5-acetamido-1-pentene. In previous studies it was found that under conditions of minimum charring, esters which could pyrolyze to yield two isomeric olefins almost always yielded the pure, least-branched olefin. However, all of the amides which pyrolyzed in this study produced mixtures which contained substantial amounts of both possible isomers.

In the pyrolysis of an ester, liberation of the acid is believed to occur by means of a *cis* elimination in which the carbonyl oxygen approaches and extracts a hydrogen from the β -carbon of the alkyl group in the same molecule. In lactones, the carbonyl oxygen and the β -hydrogen are attached to the same carbon chain. If the mechanism is actually as described above, a small-ring lactone should not undergo pyrolysis while in a large-ring lactone the carbonyl oxygen and the β -hydrogen should have enough freedom of movement to allow pyrolysis to produce an ω -unsaturated carboxylic acid.

γ -Butyrolactone and γ -hydroxyvaleric acid lactone, as predicted, yielded only negligible amounts of acid at temperatures as high as 590°. Examination of the Fisher-Taylor-Hirschfelder model indicated that the ring size of 6-hydroxyhexanoic acid lactone was at the transition point between lactones which would not pyrolyze and lactones which would. This prediction was verified experimentally; under normal conditions the seven-membered ring pyrolyzed to only a slight extent while under severe conditions it gave a moderate yield of 5-hexenoic acid. 6-Hydroxyheptanoic acid lactone, 9-hydroxynonanoic acid lactone and 11-hydroxyhendecanoic acid lactone pyrolyzed to give high yields of the corresponding ω -unsaturated acids.

Glycidyl acetate and methyl carbonate were pyrolyzed in an attempt to prepare methylenethylene oxide. In either case a small amount of the desired compound may have been present in the pyrolysis mixture, but the predominant product was acrolein.

Benzoyltrimethylsilane was prepared and subjected to pyrolysis conditions in an attempt to prepare polymethyl-enedimethylsilane. At 650° or below, the compound was recovered unchanged. At 700° a small amount of degradation occurred, but no polymeric material was obtained.

158 pages. \$2.10. Mic 57-2340

THE REACTION OF N-BROMOSUCCINIMIDE
WITH DIHYDROPYRAN

(Publication No. 21,659)

Cataldo Cialdella, Ph.D.
Case Institute of Technology, 1956

The reaction of N-bromosuccinimide with dihydropyran was investigated in order to study the mechanism for the reaction and some of the factors which could affect the mechanism.

The products identified in the reaction mixture were 3-bromodihydropyran, 2,3-dibromotetrahydropyran, and 2-succinimidyl-3-bromotetrahydropyran (both the "cis" and "trans" isomers). There was no evidence found for any allylic bromination to form 4-bromodihydropyran. Benzoyl peroxide and oxygen were observed to produce only a small acceleration of the reaction rate.

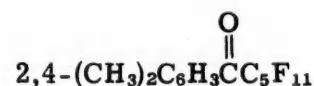
A mechanism is proposed for the reaction involving addition of positive bromine to the 3-position of dihydropyran to form the reactive intermediate leading to the products previously mentioned. The evidence suggested that a free radical mechanism was also involved, but to a much smaller degree.

30 pages. \$2.00. Mic 57-2341



The compounds prepared were for R equal to the following: CF_3- , C_2F_5- , C_3F_7- , C_4F_9- and $\text{C}_5\text{F}_{11}-$.

Using meta-xylene as the aromatic compound and caproforyl acid chloride, the ketone was:



The ketones did not entirely follow the first member of the series, trifluoroacetophenone, in their chemical reactions. The ketones split in the presence of dilute alkali to form a metallic salt of an organic acid and a monohydrofluorocarbon. They formed 2,4-dinitrophenylhydrazones as does trifluoroacetophenone, but a sodium bisulfite addition complex could not be prepared and the carbonyl oxygen could not be replaced by chlorine as does the first member of the series, trifluoroacetophenone.

2,4-Dinitrophenylhydrazones were prepared from the ketones and some of their physical properties determined.

A series of aromatic esters of fluorocarbon acids were prepared by the reaction of a fluorocarbon acid anhydride and phenol. The esters were of the following type:



The compounds prepared were for R equal to the following: CF_3- , C_2F_5- , C_3F_7- , C_4F_9- and $\text{C}_5\text{F}_{11}-$.

These compounds were found to be resistant to acid hydrolysis but saponified readily by dilute alkali. The first member of the series reacted with phosphorous pentachloride replacing the carbonyl oxygen with two chlorine atoms and forming an α,α -dichloro phenyl ether, phenoxy-2,2,2-trifluoro-1,1-dichloroethane.

Difluoromethyl phenyl ether was prepared by passing difluorodibromomethane through a mixture of sodium phenoxide and anhydrous acetone. At the present time this ether is the only stable difluoromethyl ether.

p-Propforyl toluene was prepared by the reaction of propforyl iodide with p-tolyl lithium.

o-Propforyl phenol was prepared by irradiating a mixture of propforyl iodide and o-chloromercuriphenol with 2540 A ultraviolet light.

Fluorocarbon aromatic compounds differ widely from their organic analogs with respect to chemical and physical properties. Consequently, an accumulation of experimental data is presented contributing to the explanation of these differences.

69 pages. \$2.00. Mic 57-2342

FLUOROCARBON-AROMATIC
HYDROCARBON COMPOUNDS

(Publication No. 19,166)

Reginald F. Clark, Ph.D.
The University of Florida, 1956

It is known that aromatic compounds containing a fluorocarbon radical possess certain desirable properties, which should find wide applications if the chemistry of these compounds were further developed. Fluorocarbons are very resistant to oxidation and bacterial activity, and on this basis we can assume that it is the fluorocarbon radical on aromatic compounds which imparts these properties to the molecule. Since a direct method of attaching alkforyl groups to aromatic nuclei has not yet been reported, except by chlorination of an alkyl side chain followed by exchange reactions, an attempt was made to find a method to introduce an alkforyl group directly into the aromatic nuclei and to investigate other types of fluorocarbon aromatic compounds.

The preparation and some of the physical and chemical properties of thirty-two previously unreported fluorocarbon compounds are presented. They may be summarized as follows:

A series of fluorocarbon aromatic ketones were prepared by a Friedel-Crafts reaction between a fluorocarbon acid chloride and an aromatic compound. Some of their chemical and physical properties were determined. With benzene the ketones were of the type:



The compounds prepared were for R equal to the following: C_2F_5- , C_4F_9- and $\text{C}_5\text{F}_{11}-$.

Using toluene as the aromatic compound, the ketones were of the type:

A STUDY OF THE RATES OF THE BECKMANN REARRANGEMENT OF SOME ORTHO-SUBSTITUTED ACETOPHENONE OXIMES

(Publication No. 21,682)

Walter E. Cole, Ph.D.
Vanderbilt University, 1957

Supervisor: Dr. D. E. Pearson

A study of the rates of rearrangement of *o*-substituted acetophenone oximes was undertaken in order to obtain information to supplement kinetic data available for the *m*- and *p*-substituted oximes of this series. These data were to be used as evidence to support existing concepts of the Beckmann rearrangement mechanism or to lead to the formulation of a new rearrangement mechanism.

The rates of rearrangement were followed by gravimetric determination of the 2,4-dinitrophenylhydrazones derived from the unchanged oximes. The precision of analysis reached in other studies was not attainable in this work due to the lower melting points and greater solubilities of the 2,4-dinitrophenylhydrazones. Another factor contributing to the difficulty in obtaining accurate analyses was the tendency for the oximes (particularly the *o*-methylacetophenone oxime) to rearrange even in dilute acid. Several modifications of the usual methods were necessary in order to obtain even such precision as is noted in the experimental results. In spite of the fact that the results are less precise than desired, the precision is considered perfectly adequate for showing the greatly accelerated rates of rearrangement in the *o*-substituted acetophenone oximes and thus to lend support to the prevailing theories of steric strains in molecules and to the proposed mechanism for the Beckmann rearrangement.

The data obtained in this study show that the rearrangement rates of *o*-substituted acetophenone oximes are much greater than the rates for the *meta* and *para* isomers. Since it may be assumed that the electrical effect of a substituent group is approximately the same in the *ortho* as in the *para* position, a rough evaluation of the steric effect may be obtained from the ratio of the *ortho* to *para* rates of rearrangement.

<i>o</i> -Methyl/ <i>p</i> -methyl rate:	107
<i>o</i> -Chloro/ <i>p</i> -chloro rate:	15
<i>o</i> -Nitro/ <i>p</i> -nitro rate:	6

This increase in rearrangement rates for *ortho*-substituted acetophenone oximes was anticipated in view of published works which described the rearrangement of some *o*-substituted acetophenone oximes in dilute hydrochloric acid solution. These results may be explained by consideration of both electrical and steric effects of the *ortho* groups. The steric effect accelerates the rate of rearrangement and retards the rate of hydrolysis. With 2-iodoacetophenone, only hydrolysis took place because the steric effect is completely overshadowed by the electrical effect of the iodine atom which slows the rate of rearrangement and increases the rate of hydrolysis. With 2,4-dimethyl-6-methoxyacetophenone oxime, a quantitative yield of the rearrangement product was obtained because all electrical and steric effects tend to increase the rate of rearrangement and to decrease the rate of hydrolysis.

No evidence was found during this study to conflict with

the proposed mechanism for the Beckmann rearrangement and it is felt that considerable support for this mechanism was obtained from the results. Of course, the loss in coplanarity between the α -oximinoethyl grouping and the ring will not in itself explain the steric acceleration of rates. It may be that the ring system is more susceptible to bonding with the electron deficient nitrogen atom when resonance interactions are diminished. Another and a more appealing interpretation is that one of the initial steps in the rearrangement of any oxime is the twisting of the α -oximinoethyl grouping out of the plane of the ring so that the nitrogen and carbon atom are equidistant above and below the plane of the ring. The process of nitrogen-ring bond breaking is thus facilitated. In some *ortho*-substituted acetophenone oximes the twisting out of the plane of the ring is already accomplished and the energy required for activation may be diminished.

The attempted rearrangement of *o*-methoxyacetophenone oxime produced a sulfonated product rather than the usual rearrangement product. The parent ketone did not undergo sulfonation until subjected to much more severe reaction conditions than those under which the oxime was sulfonated. The comparative ease of sulfonation of *o*-methoxyacetophenone oxime is explained on the basis of steric effects. A loss of coplanarity between the aromatic ring and the α -oximinoethyl grouping is brought about by a bulk effect of the neighboring *ortho* substituent group. As a result of the loss in coplanarity, the resonance interaction between the ring system and the α -oximinoethyl grouping which normally deactivates the ring system toward electrophilic reagents is diminished. This leads to sulfonation of the oxime in a manner similar to a hydrocarbon rather than an aromatic ketone or derivative.

o-Nitroacetophenone oxime yielded three fractions of crystals after preparation. On repeated crystallizations of the two higher melting fractions it was possible to obtain a sample of sufficient purity for the rate studies. The lower melting fraction of the oxime could not be purified by usual methods. A study of the ultraviolet absorption spectra of this material indicated that it might contain the *syn*-form of the oxime.

99 pages. \$2.00. Mic 57-2343

SYNTHESIS AND PROPERTIES OF HOMOLOGOUS META- AND PARA-CYCLOALKYLBENZOIC ACIDS

(Publication No. 20,670)

Thomas Furman Corbin, Jr., Ph.D.
The Ohio State University, 1956

The reactivities of cycloalkanes are markedly affected by ring size. Existing data, however, do not allow differentiation of fundamental steric and electrical effects within any series of homologous cyclic compounds. A study was therefore initiated of the effects of *m*- and *p*-cycloalkyl and *m*- and *p*-cycloalkenyl groups on the properties of benzoid compounds. In the present dissertation *m*- and *p*-cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, 1-cyclopentenyl, and 1-cyclohexenylbenzoic acids were synthesized, and their apparent ionization constants were determined.

Reaction of dihydrocinnamyl bromide and *N*-bromosuccinimide followed by cyclization of the intermediate 1,

3-dibromo-1-phenylpropane yielded phenylcyclopropane. Bromination of phenylcyclopropane gave p-bromophenylcyclopropane, which was converted to p-cyclopropylbenzoic acid by reaction with magnesium and carbon dioxide or with cuprous cyanide followed by hydrolysis of the resulting p-cyclopropylbenzonitrile. p-Bromophenylcyclopropane was also synthesized from p-dibromobenzene.

Nitration of phenylcyclopropane in acetic anhydride gave a mononitrated product comprised principally of o-cyclopropynitrobenzene (>72 per cent) and p-cyclopropynitrobenzene (>12 per cent). The mixture of o- and p-cyclopropynitrobenzenes was reduced to o- and p-cyclopropylanilines; bromination of these amines in acetic acid-acetic anhydride-potassium acetate yielded 4-bromo-2-cyclopropylacetanilide. Hydrolysis of the anilide followed by deamination gave m-bromophenylcyclopropane, which was converted to m-cyclopropylbenzonitrile and then to m-cyclopropylbenzoic acid.

Phenylcyclobutane was obtained upon hydrogenolysis of 1-phenylcyclobutanol, as prepared from phenylmagnesium bromide and cyclobutanone. m- and p-Cyclobutylbenzoic acids were prepared from phenylcyclobutane by routes involving bromination and nitration similar to that used in synthesis of m- and p-cyclopropylbenzoic acids.

p-(1-Cyclopentyl)benzoic acid was synthesized from p-(1-cyclopentenyl)benzonitrile, as derived from 1-(p-bromo-phenyl)cyclopentene. 1-(p-Bromophenyl)cyclopentene was derived from 1-(p-bromophenyl)cyclopentanol, as obtained from p-bromophenylmagnesium bromide and cyclopentanone. Hydrogenation of p-(1-cyclopentenyl)benzoic acid gave p-cyclopentylbenzoic acid. m-Cyclopentyl, m-(1-cyclopentenyl), m- and p-(1-cyclohexenyl), and m- and p-cyclohexylbenzoic acids were prepared by reactions analogous to those used for preparing p-cyclopentylbenzoic acid.

The apparent pKa values of the benzoic acids of the present study in 50 per cent aqueous ethanol at 25° are given in parenthesis (meta and para, respectively) for the following substituents: cyclopropyl (5.85, 5.91), cyclobutyl (5.89, 5.885), cyclopentyl (5.92, 5.89), cyclohexyl (5.93, 5.89), 1-cyclopentenyl (5.79, 5.80), 1-cyclohexenyl (5.85, 5.82), isopropyl (- --, 5.89), and hydrogen (5.70). Although the differences are small and thus the conclusions are tentative, the ionization constants of the m-cycloalkylbenzoic acids indicate that the inductive effects (+ I) of cycloalkyl groups may increase with increasing ring size. The p-cycloalkyl substituents may release electrons by conjugative effects. Conjugative effects from the 5- and 6-membered ring p-acids may arise from C-H hyperconjugation; in 3- and 4-membered rings, C-C hyperconjugation may be the origin of electron release. The fact that p-cyclopropylbenzoic acid is the weakest p-substituted acid whereas m-cyclopropylbenzoic acid is the strongest m-cycloalkylbenzoic acid is indicative of the ability of the cyclopropane ring to release electrons by conjugative effects. The order of differences in pKa values of the para- and meta-substituted benzoic acids may be interpreted as partially indicative of a diminishing conjugative effect with increasing ring size.

The smaller pKa values of m- and p-(1-cyclopentenyl)-benzoic acids than of m- and p-(1-cyclohexenyl)benzoic acids may be attributed to greater internal strain in the 5-membered ring which results in a diminished inductive effect (+ I). The fact that p-(1-cyclopentenyl)-benzoic acid is weaker than m-(1-cyclopentenyl)benzoic acid, whereas the opposite is true for m- and p-(1-cyclohexenyl)benzoic acids, is indicative that the relative stabilities of exo- and

endocyclic double bonds in 5- and 6-membered rings may affect the ability of a double bond in entering into conjugation with unsaturated centers. The conclusions derived from this research should be confirmed by further experimentation.

166 pages. \$2.20. Mic 57-2344

THE CATALYZED DECARBOXYLATION OF BENZOYLFORMIC ACID

(Publication No. 18,345)

Abraham S. Endler, Ph.D.
Polytechnic Institute of Brooklyn, 1956

Adviser: Dr. E. I. Becker

The rate of decarboxylation of benzoylformic acid, catalyzed by 3-aminoökindole, 3-methyl-3-aminoökindole, and α -phenylglycine, was studied at 50°, 70°, 80°, 90°, and 100°C.

This type of reaction has been considered by Langenbeck and others to be analogous to the action of natural enzymes such as pyruvic carboxylase. Previous work in this laboratory has indicated the probability of a prototropic rearrangement of the active Schiff-base intermediate being a requirement for catalysis. The possibility of a cyclic transition state had also been advanced as a basis for the activity of 3-aminoökindole as a catalyst.

The aims of this work included first the preparation of 3-methyl-3-aminoökindole, a compound differing from the catalytically active 3-aminoökindole only by the replacement of a hydrogen in the 3-position by a methyl group. The catalytic behavior of this compound would test the validity of the proposed prototropic step in the mechanism.

Secondly, it was desired to analyze the reaction kinetically in order to obtain the rate constant for the decarboxylation of the active intermediate at various temperatures. This data would allow the calculation of the energy and entropy of activation of the reaction. A cyclic transition state would be expected to have a larger negative entropy of activation than an open-chain molecule.

The reaction rate was determined by measurement of the volume of carbon dioxide evolved under constant pressure. The apparatus employed was suitable for readings at intervals of one minute.

3-Methyl-3-aminoökindole was successfully synthesized; and, in accordance with the postulated mechanism, was found to be ineffective as a catalyst compared to 3-aminoökindole.

The rate constants for the first-order decarboxylation of the reaction intermediate were obtained by a graphical method. A function of the reaction rate, plotted vs. time, was extrapolated to zero time. At 80°C., the rate constant for 3-aminoökindole is $5.9 \pm .4 \text{ min.}^{-1}$, and for α -phenylglycine, $0.34 \pm .05 \text{ min.}^{-1}$. The energy of activation at 80° is $(18.5 \pm 1.5) \times 10^3 \text{ cal./mole.}$ for 3-aminoökindole; and $(19.5 \pm 2.5) \times 10^3 \text{ cal./mol.}$ for α -phenylglycine. This indicates a somewhat larger negative entropy of activation for α -phenylglycine.

The results corroborate the proposed requirement that the catalytic intermediate be capable of undergoing prototropic rearrangement; but do not support the suggested cyclic transition state.

Measurements of the inhibiting effect of water and of benzaldehyde were also made; and the effect of variation in the concentration of benzoylformic acid and of potassium benzoylformate in the reaction mixture was also determined.

Previous opinion that benzoin is an inhibitor of the reaction was found to be incorrect. Hydroquinone was found to have no effect on the rate.

It is proposed that the key step in the reaction is the breakdown of the anion of the active intermediate into carbon dioxide and a methyleneazomethine anion which is resonance-stabilized by interaction with the oxindole ring. This is an extension of a mechanism previously proposed for the Strecker degradation of α -aminoacids.

Work is also reported on the Schiff bases derived from isatin, in which the color of the compounds is correlated with the position of the azomethine double bond.

298 pages. \$3.85. Mic 57-2345

SOME EFFECTS OF THE SORPTION OF BASES AND CHLORINE OXIDATION ON THE PROPERTIES OF A CORNSTARCH

(Publication No. 21,754)

Richard Ray Hahn, Ph.D.
Kansas State College, 1957

As a result of a program concerned with the study of the properties of granular starch, one of the beliefs developed was that an increase in the glutinous character of a starch paste could be obtained by increasing the water permeability of the granule. It was thought that a mild surface oxidation might provide a means of accomplishing this.

Accordingly, a problem was outlined to study the effects of alkali sorption and chlorine oxidation on the properties of a cornstarch. The variables to be considered were type of base, concentration of base, time of reaction, and temperature of reaction. The properties to be measured were amount of base sorbed, pasting characteristics, alkali number, iodine affinity, and carboxyl group content.

The literature of the oxidation of starch is quite extensive but few of these studies have been concerned with a mild oxidation of granular starch. There has been little argument among workers as to the mechanism of the reaction and its effect on the physical properties of the oxidized starches.

The reaction was carried out in a specially constructed six-necked flask provided with openings for a stirrer, gas diffuser, electrodes of a pH meter, thermometer, and a gas outlet. The flask was maintained at the desired temperature in a thermostatically-controlled water bath.

In order to avoid the complications which would be introduced by use of a commercially-produced cornstarch, the starch used in this study was milled from corn in this laboratory. Mild conditions were used, and a high grade cornstarch was obtained.

It was found that the sorption of sodium hydroxide increased in an irregular fashion as the time of reaction, temperature of reaction, and concentration of alkali increased. The maxima and minima occurring in the sorption curves were correlated with maxima and minima in

the alkali number curves of the oxidized products. The alkali number was interpreted as being a measure of the strain existing in the granule. A maximum followed by a minimum was held to be due to a build-up of strain followed by a structural rearrangement allowing relief.

The viscosity characteristics of these alkali-treated starches indicated an increase in surface structure and an increase in granule permeability. The increased surface structure was retained after reaction with chlorine but the rate of gelatinization decreased.

The sorption of sodium carbonate by cornstarch is at its maximum value under mild conditions. The amount of sorption decreases if any of the reaction conditions are increased. Treatment of these starches with chlorine water gave large increases in the hot viscosity of the pastes, indicating an oxidation of the surface region.

When a combination of sodium hydroxide and sodium carbonate was used, an increase in glutinous character of the oxidized products was obtained if the sodium carbonate was allowed to react first. The sorption data indicated that the bases were acting independently.

Oxidation of isopropyl-alcohol-treated starches gave starches with increased surface structure. The high cold viscosity was a result of the reaction temperature rather than the presence of alcohol.

The reaction was thought to occur at the 1, 5-oxygen bridge of the glucopyranose units. If it took place at the end of a chain, a free carboxyl group was formed. If the middle of the chain was attacked, an ester group was formed. This ester group was found to be labile to cleavage during gelatinization.

The oxidation of cornstarch by these methods proved capable of giving a controlled increase in the glutinous character of the starch pastes. The increased structure in the surface region, limited the extent to which this could be accomplished.

104 pages. \$2.00. Mic 57-2346

KINETIC AND EQUILIBRIUM STUDIES OF CYCLIC KETAL FORMATION AND HYDROLYSIS

(Publication No. 21,475)

Robert John Harper, Jr., Ph.D.
The Ohio State University, 1957

For theoretical and practical reasons the rates of hydrolysis and formation of cyclic ketals and the equilibrium of the same reactions were studied. From a theoretical viewpoint, the changes in the ring-promoting effect of the gem-dialkyl grouping as the groups were changed from methyl to ethyl to isopropyl were of interest. From a practical viewpoint, the effect of changes in diol structure on the preferential blocking and regeneration of ketonic groups in polyfunctional compounds which contained 5- and 6-membered ring ketones was of interest. The fifteen cyclic ketals derived from the ketones, cyclohexanone, cyclopentanone, and 2-methylcyclopentanone, and the glycals, ethylene glycol, 1,3-propanediol, 2,2-dimethyl-1,3-propanediol, 2,2-diethyl-1,3-propanediol, and 2,2-diisopropyl-1,3-propanediol, were prepared. The rates of hydrolysis and the equilibrium constants for the over-all reaction were determined.

The ketal hydrolysis was performed in a (70-30)

dioxane-water solution at 30°. The reaction was followed by a measurement of the increase in the carbonyl absorption at 287 millimicrons with a Beckmann D.U. spectrophotometer. For ketals derived from cyclic ketones and 1,3-propanediols, the relative rates of hydrolysis increase in the following order: cyclohexanone, cyclopentanone, and 2-methylcyclopentanone. For ketals derived from the cyclic ketones and ethylene glycol, the relative rates of hydrolysis increase in the following order: cyclohexanone, 2-methylcyclopentanone, and cyclopentanone. The ratio of the hydrolysis rate of a ketal derived from 2-methylcyclopentanone and a glycol to the hydrolysis rate of a ketal derived from cyclohexanone and the same glycol is larger for ketals derived from 2,2-diethyl-1,3-propanediol (ratio 12.7) and 2,2-dimethyl-1,3-propanediol (ratio 11.5) than it is for ketals derived from ethylene glycol (ratio 8.0). For ketals derived from a cyclic ketone and a 1,3-propanediol, the rate of hydrolysis decreased with every increase in the size of the groups at the C₂ position. This relationship was valid for the dihydrogen, dimethyl, diethyl, and diisopropyl groups, and occurred in the three series of ketals studied. However, a proportionately greater decrease in the hydrolysis rate took place on substituting the dimethyl group for the dihydrogen than occurred on replacing any dialkyl group with its next larger counterpart. Finally, ketals derived from 1,3-propanediol underwent hydrolysis more rapidly than ketals derived from ethylene glycol.

The reaction between a cyclic ketone and 2,2-dimethyl-1,3-propanediol to form a cyclic ketal and water was studied under equilibrium conditions at 30° with dioxane as the solvent. The equilibrium shifted to favor the free ketone as the carbonyl reactant was changed from cyclohexanone (K_e=2.) to cyclopentanone (K_e=0.2) to 2-methylcyclopentanone (K_e=0.04).

Qualitative studies on the ease of formation of cyclic ketal and the relative ketal formation rates derived from related equilibrium and hydrolysis data indicated smaller differences in the rates of formation of ketals derived from cyclohexanone, cyclopentanone, and 2-methylcyclopentanone than the differences observed in the rates of hydrolysis of the same ketals. The relative formation rate constants of ketals derived from 2,2-dimethyl-1,3-propanediol increased as the ketone was changed from 2-methylcyclopentanone to cyclopentanone to cyclohexanone.

Finally, a theoretical analysis was made of the product compositions arising on the hydrolysis of diketals formed from a hypothetical dicarbonyl compound containing 5- and 6-membered ring ketones and several 1,2- and 1,3-glycols. A similar analysis was applied to the equilibrium reaction between the hypothetical dicarbonyl compound and 2,2-dimethyl-1,3-propanediol. In these analyses, emphasis was placed on determining the percentages of various products arising and on specifying the conditions under which most of the 6-membered ring ketone would be present as a cyclic ketal and most of the 5-membered ring ketone would be present as the free ketone.

222 pages. \$2.90. Mic 57-2347

COORDINATION COMPOUNDS OF BENZOHYDROXAMIC ACID AND 1,10-PHENANTHROLINE

(Publication No. 19,412)

Paul Edward Holkeboer, Ph.D.
Purdue University, 1956

Major Professor: Warren W. Brandt

Coordination Compounds of Bensohydroxamic Acid

The reactions of titanium(IV), molybdenum(VI), tungsten(VI), and uranium(VI) with benzohydroxamic acid were investigated in order to better understand how to remove their interference in the quantitative determination of vanadium(V) using benzohydroxamic acid and 1-hexanol. This investigation has shown that titanium(IV), molybdenum(VI), and tungsten(VI) form insoluble species with benzohydroxamic acid in acidic solutions. The titanium(IV) species remains insoluble up to pH 12.0, whereas, the molybdenum(VI) species dissolves at pH 3.0 with the formation of a yellow soluble species and the tungsten(VI) compound dissolves forming a colorless solution. Uranium(VI) and benzohydroxamic acid react to form a 1:1 complex at pH 4.0 and most probably a 1:2 complex at pH 9.0. The uranium(VI) complex can be extracted into isoamyl alcohol and tributyl phosphate. Partial extraction into 1-hexanol of a molybdenum(VI)-benzohydroxamic acid species occurs from solutions of pH 2.0-4.0.

The maximum amount of titanium(IV), molybdenum(VI), tungsten(VI), and uranium(VI) which can be present in the determination of vanadium(V) without causing error was established.

Experimental evidence was found indicating an interaction between uranium(VI) and vanadium(V).

A Magnetic Susceptibility Study of the Vanadium-Benzohydroxamic Acid System and the Boric Acid-Sulfuric Acid System

A magnetic susceptibility study was performed on the 1:2 vanadium(V)-benzohydroxamic acid complex and on boric acid in one hundred per cent sulfuric acid. The vanadium system was investigated in order to determine if reduction of vanadium(V) to vanadium(IV) had occurred during complexation, since benzohydroxamic acid is an analogue of the reducing agent hydroxylamine and the boric acid system was investigated to determine if any unpaired electrons are present in the boron species. Both of these species were diamagnetic, proving that no reduction of vanadium(V) occurred during complexation with benzohydroxamic acid and also proving that the boron species in one hundred per cent sulfuric acid does not contain any unpaired electrons.

The Copper 1,10-Phenanthroline System

A new copper(II)-1,10-phenanthroline species was identified. This species is green with an absorbance maximum at 455 m μ and forms when oxygen is passed through a neutral or basic solution of the purple copper(I)-1,10-phenanthroline complex which has been prepared by reduction with hydroxylamine hydrochloride of the copper(II) complex. The results of the experimental work on this system indicate that the green species exists as

$[\text{Cu}(\text{phen})_2\text{Cl}]^+$, in which the copper(II) ion has a coordination number of five or six, the sixth position probably occupied by a water molecule.

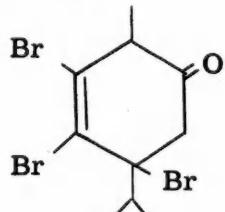
146 pages. \$2.00. Mic 57-2348

THE STRUCTURE OF THUJONE TRIBROMIDE

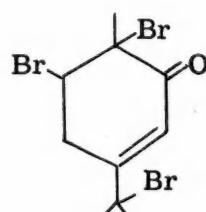
(Publication No. 21,571)

Phillip Murray Iloff, Jr., Ph.D.
Stanford University, 1957

The formula (I) assigned to thujone tribromide by Wallach did not have a firm basis and was ruled out by the ultraviolet absorption spectrum. The author therefore undertook the investigation which led to the establishment of structure II.

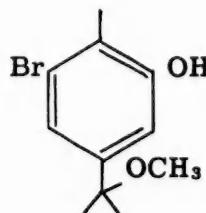


(I)



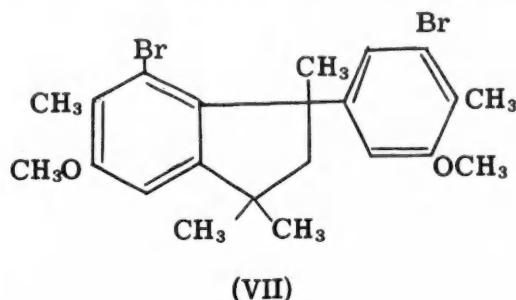
(II)

The structure II is supported by the ultraviolet absorption spectrum: $\lambda_{\text{max}} 243 \text{ m}\mu, \epsilon_{\text{max}} 11,700; \lambda_{\text{max}} 337 \text{ m}\mu, \epsilon_{\text{max}} 185$. The infrared absorption spectrum and chemical data also support the structure. The bromomethoxycarvacrol derived from thujone tribromide by treatment with sodium methoxide is shown to have structure III by ultraviolet and infrared absorption spectra and chemical data. The structure III is supported by the high resolution proton magnetic resonance spectrum of the compound.



(III)

The bromomethoxycarvacrol (III) was treated with benzene diazonium hydrogen sulfate to yield the coupling product 3-bromo-5-(2-methoxy-2-propyl)-2-methyl-6-phenylazophenol $\text{C}_{17}\text{H}_{19}\text{O}_2\text{N}_2\text{Br}$ (IV), m.p. $120-21^\circ$, insoluble in dilute aqueous sodium hydroxide. When the phenol (III) was treated with Raney nickel alloy in base followed by acidification, a phenol $\text{C}_{20}\text{H}_{24}\text{O}_2$ (V), m.p. $175-76^\circ$, with the ultraviolet absorption $\lambda_{\text{max}} 282 \text{ m}\mu, \epsilon_{\text{max}} 5,650$ was formed. The bromomethoxycarvacrol (III) was heated with hydrobromic acid to give a phenolic dimer $\text{C}_{20}\text{H}_{22}\text{O}_2\text{Br}_2$ (VI), m.p. $221.5-222^\circ$ with the ultraviolet absorption $\lambda_{\text{max}} 285 \text{ m}\mu, \epsilon_{\text{max}} 5,560$. The phenolic dimer (VI), when treated with methyl sulfate was converted to its dimethyl ether which was assigned the phenylindan structure (VII) on the basis of its high resolution proton magnetic resonance spectrum. It is concluded that the phenols (V) and (VI) have the corresponding phenylindan structures. The



(VII)

acid-catalyzed dimerization of structures related to styrene, including natural products such as isoeugenol, is reviewed briefly, and a scheme of reactions is proposed to account for the formation of the thujone tribromide (II) and the bromomethoxycarvacrol (III).

99 pages. \$2.00. Mic 57-2349

THE POSITION ISOMER DISTRIBUTION IN ADDITION REACTIONS OF HYDROGEN BROMIDE WITH OLEIC ACID AND ITS ESTERS

(Publication No. 21,418)

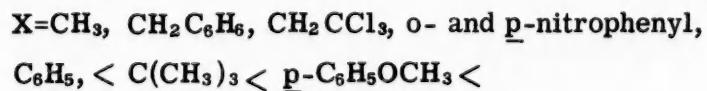
Eric Jungermann, Ph.D.
Polytechnic Institute of Brooklyn, 1957

Oleic acid and a series of its esters were reacted with hydrogen bromide under conditions favoring additions either by a free radical or by an ionic mechanism. Variations of the solvents, catalysts, temperature, dilution and of the ester groups were investigated.

An analytical scheme was developed to analyze the mixture of bromoesters obtained in these reactions, involving these steps:

1. Dehydrobromination.
2. Oxidation of the resultant mixed octadecenoic acids with a permanganate-periodate reagent to the mono- and dicarboxylic acids.
3. Separation of the mono- and dicarboxylic acids followed by analysis of the mixture of dicarboxylic acids by a standard chromatographic procedure.

In all the free radical additions examined a 50:50 distribution of position isomers was found. In the series of reactions run under ionic conditions, two variables were noted which affected the relative amounts of the 9- and 10-bromo-isomers formed. The first was a function of the concentration; greater dilution favoring the formation of the 9-position isomer. The second depended on the nature of the carboxylate group, COOX . The amount of the 9-bromostearate formed increased in the following order:



A mechanism was proposed to interpret these results. It assumed the formation of a cyclic intra-molecular intermediate where some bonding occurred between the central carbon-carbon double bond and the carboxylate group. On formation of this intermediate, the motion and position of the seven carbon chain between these two functional groups is restricted leaving the 9-carbon atom more open to attack by an anion than the 10-carbon.

Evaluation of some earlier investigations which reported

definite directional effects in the reaction of similar eighteen carbon fatty acid derivatives showed that these results could be explained in terms of the proposed mechanism. 104 pages. \$2.00. Mic 57-2350

I. A STUDY OF CIS- AND
dl-TRANS-1,2-DIPHENYLCYCLOPROPANE
II. THE REARRANGEMENT OF THE
DIASSTEREOISOMERIC 2-(*p*-CHLOROPHENYL)-1,
2-DIPHENYL-1,2-ETHANEDIOL CHLOROACETATES
(Publication No. 20,869)

Hubert Elmer Knipmeyer, Ph.D.
University of Illinois, 1957

I. The synthesis and determination of the stereochemistry of cis- and dl-trans-1,2-diphenylcyclopropane (I) has been accomplished. It was found that the configurations of the isomeric diphenylcyclopropanes could be assigned by comparison of their ultraviolet spectra with those of cis- and trans-stilbene oxide. Equilibration of cis- and dl-trans-I was effected using sodium amide in dl-n-butylamine at 150°. Partial isomerization also resulted from treatment of the isomers with organolithium compounds at room temperature in an ether solvent. A tentative value of the equilibrium constant for the equilibration reaction at 150° is 4.10 ± 0.25. This corresponds to a free energy difference of 2.3 kcal./mole, cis-I being the less stable.

A convenient synthesis of cis-1,2-diphenylcyclopentane was devised using anhydroacetonebenzil as the starting material. Reduction of this compound yielded a new 3,4-diphenylcyclopentanol which was oxidized to the ketone. Clemmensen reduction of this compound gives the desired hydrocarbon.

II. The synthesis of dl-erythro- and dl-threo-2-(*p*-chlorophenyl)-1,2-diphenyl-1,2-ethanediol chloroacetate has been accomplished. These esters on heating in anhydrous dimethylformamide were found to give in each case exclusively oc-p-chlorophenyldesoxybenzoin with no evidence for the formation of the isomeric p-chlorophenyl benzhydryl ketone. A kinetic study of the reaction showed that both esters underwent rearrangement at identical rates.

Rate Constants for the Rearrangement of II in DMF (sec.-1)

T (°C)	<u>dl-erythro</u> -II	<u>dl-threo</u> -II
160.5	$1.10 \pm 0.02 \times 10^{-4}$	$1.16 \pm 0.01 \times 10^{-4}$
170.5	2.59 ± 0.16	2.48 ± 0.04
180.5	5.47 ± 0.13	

It is proposed that the mechanism of this reaction involves initial rearrangement of the sec-ester to a tert-ester followed by a concerted loss of chloroacetate anion and hydrogen migration with subsequent removal of a proton to give the product. 155 pages. \$2.05. Mic 57-2351

ABSORPTION SPECTRA OF SOME ORTHO-
AND META-SUBSTITUTED TETRACYCLONES

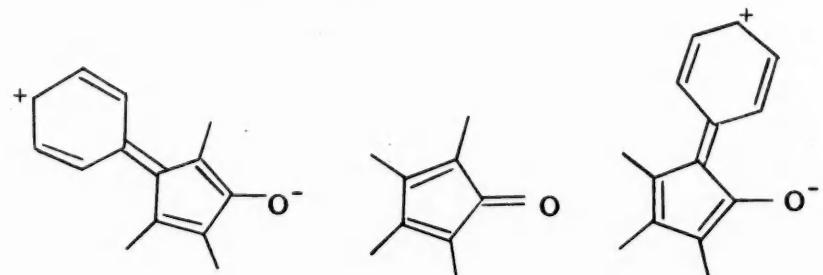
(Publication No. 16,789)

Marvin Koral, Ph.D.
Polytechnic Institute of Brooklyn, 1956

Adviser: Ernest I. Becker

Since the early postulates concerning color and structure a number of correlations have been empirically established. A basic change from the earliest hypotheses is that now all groups are considered to absorb in the ultraviolet or visible region and as a consequence, the electronic absorption is a result of the combination of the group effects. Thus, groups formerly considered as chromophores are now regarded as those with relatively easily polarized electronic systems. Auxochromes are groups which, by means of their electron-attracting or electron-releasing effect, affect the ease of polarization. Thus, extension of a conjugated chain lowers the energy requirement for polarization and shifts the absorption maximum to longer wave lengths. With cross-conjugated systems, these correlations have been little studied.

Prior efforts to correlate the data for cross-conjugated systems may be summarized in the following way: for a given series of molecules, the different electronic paths as indicated by resonance structures may be correlated with specific absorption bonds in the range 200-800 mu. It was the purpose of this investigation to extent the prior correlations particularly by studying the absorption spectra of tetracyclones with ortho and meta substituents. Thus, ten new tetracyclones were prepared and examined. Fluorine, bromine and methoxyl were introduced singly and in pairs in the ortho, meta positions.



The spectral data show that the introduction of various groups in the ortho-positions of the 3- and 4-phenyl rings effects a hypsochromic and hypo-chromic shift of the 342 mu peak. This can be definitely attributed to steric factors.

When electron-repelling groups were placed in the meta-positions of the 3- and 4-phenyl rings, a decrease in intensity was noted. This may be explained by the fact that these groups cause a loss of electron density minimizing the possibility of cross-conjugation.

The postulation of Trucker and Coan (15,58) that the high intensity peak at 262 mu is due to a twinned stilbene-type resonance has been further validated. The special data of the new cyclones show little change at this peak which conforms with their hypothesis. It is believed that the 3- and 4-phenyl rings are more twisted out of the plane of the five membered ring as compared to the 2- and 5-phenyl rings. Therefore, the introduction of groups into the already twisted 3- and 4-phenyl rings should result only in minor changes.

In achieving the synthesis of these new tetracyclones

two observations are noteworthy. The reaction of *o*-bromo-benzamide and excess benzylmagnesium chloride resulted in a metal-halogen interchange. The product was desoxy-benzoin instead of the *o*-bromoderivative. This interconversion closely resembles the halogen-metal interchange typical of organolithium compounds.

To avoid this dehalogenation the reaction between a mandelonitrile and a Grignard reagent was exploited. The conditions for a good yield in this seldom used reaction were investigated. It has been shown that over-all yields of 35-62% from aldehyde to benzil could be obtained via this route.

Incidental to this work, the rearrangement of tetracyclone to dihydrophephenycyclone was examined. The most effective conditions for reaction are (1) 1 mole of anhydrous aluminum bromide as catalyst, (2) reaction period of four hours, (3) use of benzene as solvent and (4) room temperature. The product, dihydrophephenycyclone, was more fully characterized by means of a molecular weight determination.

This reaction is apparently an intramolecular cyclization of the Scholl type. The 3- and 4-phenyl rings couple in the *ortho*-position and the two hydrogens become attached to the same two carbons that the 2- and 5-phenyl rings are attached to. 75 pages. \$2.00. Mic 57-2352

**A KINETIC AND ISOTOPE EFFECT STUDY
OF A BORDERLINE CASE IN NUCLEOPHILIC
SUBSTITUTION: THE REACTION BETWEEN
BENZYL CHLORIDE AND POTASSIUM
CYANIDE IN EIGHTY PER CENT ETHANOL**

(Publication No. 20,605)

Pandarathil Madhavan Nair, Ph.D.
University of Arkansas, 1957

Major Professor: Arthur Fry

There has been a great deal of controversy over the justifiability of the classification of nucleophilic displacement reactions into the mechanistic categories " S_N1 " and " S_N2 ". The controversy centers around the role of solvents in these reactions. The reactions of benzyl halides are known to be on the borderline between the mechanistic categories " S_N1 " and " S_N2 ". It was hoped that isotope effect and kinetic studies of these reactions would throw some light on the intimate details of the displacement process and would thus help decide on questions of classification. A beginning in this direction has been made in the kinetic and isotope effect study, reported here, of the reaction between benzyl chloride and potassium cyanide in eighty per cent ethanol.

The rate of formation of chloride ions in the reaction was found to display mixed order kinetics, i.e., the initial first order rate constants showed a dependence on the concentration of cyanide ions that could not be attributed to a salt effect. Contrary to what would normally be expected in such a situation, the approximation to first order kinetics appeared to be better for the higher concentrations of cyanide ions.

A provisional explanation has been put forward for this experimentally observed behaviour on the basis of the

existence of "covalently solvated carbonium ions," or intermediates in which the central carbon atom has been described as "penta-covalent." The postulate of the existence of this kind of intermediate was first made by Doering and coworkers to explain satisfactorily partial inversion and racemization occurring in some displacement reactions in solution.

The intermediate character of the displacement process is also reflected in the isotope effects that have been determined. The Cl^{35} - Cl^{37} isotope effect was found to be 0.74 ± 0.05 per cent. For an unassisted ionization of the halogen which would be required in an " S_N1 " mechanism, the isotope effect expected is in the neighbourhood of 1.13 per cent and for a completely concerted displacement the isotope effect should be about 0.17 per cent. The reaction appears to be nearly half way between the two mechanistic types. A significant extent of bond formation before bond rupture is complete is indicated by the observed C^{14} -isotope effect of 0.1 ± 0.3 per cent for the benzyl carbon atom. The values expected for the extreme mechanistic types, " S_N1 " and " S_N2 ", for this reaction are approximately 9.3 and 5.8 per cent respectively. The observed value seems to agree with the one expected for an S_N2 type of reaction within the precision of the measurements. However, the reaction may actually involve a considerable extent of S_N1 character in view of the probable error involved in the measured value and the uncertain nature of the variation of the contribution to the isotope effect by the term involving free energy functions. The approximate magnitude of the C^{14} -isotope effect at the cyanide carbon atom has been found to be about a per cent. The expected C^{14} -isotope effect for an S_N2 type of reaction in this case should be somewhat less than 1.4 per cent which is the contribution of the reduced mass term. For an association of benzyl carbonium ions and cyanide ions which would be required in an S_N1 mechanism the reduced mass term is 3.8 per cent. Although the isotope effect to be expected in this case is less than 3.8 per cent, the actual extent of the lowering is uncertain. Any value between zero and 3.8 per cent may thus be involved. The value that seems to be indicated by the present experiments could therefore be regarded as consistent with any of the different mechanistic pictures of the reaction. 107 pages. \$2.00. Mic 57-2353

**PART I. REDUCTION OF AROMATIC
HYDROCARBONS WITH BULKY SUBSTITUENTS
BY LITHIUM IN METHYL AMINE. REACTIONS
OF THE REDUCTION MIXTURES**
PART II. PREPARATION OF CYCLIC SILANES

(Publication No. 21,302)

John Merle Nielsen, Ph.D.
Purdue University, 1957

PART I

Major Professor: Dr. R.A. Benkeser

Section A. The composition and Reaction of the Reduction Mixtures from *t*-Butylbenzene and *i*-Propylbenzene. — *t*-Butylbenzene was reduced in 85% yield to a mixture containing about 95% olefin and 5% *t*-butylbenzene by lithium in methyl amine. All three possible olefins were shown to be present in the reduction mixture. The yield of the

nitrosochloride derivative of 1-t-butylcyclohexene which was obtained from the reduction mixture indicated at least 30% of this olefin to be present. The reduction mixture gave a fair yield of 1-t-butyl-1-chlorocyclohexene and 1-t-butyl-1,2-epoxycyclohexane when treated with hydrogen chloride and perbenzoic acid, respectively. Reaction with performic acid yielded a glycolic oil from which were isolated *trans*-4-t-butyl-1,2-cyclohexandiol and (probably) *trans*-1-t-butyl-1,2-cyclohexandiol in 7-10% yields. Hydroxylation with the $\text{OsO}_4\text{-H}_2\text{O}_2\text{-t-BuOH}$ system gave an oil from which was isolated 3% of a solid glycol (probably *cis*-1-t-butyl-1,2-cyclohexandiol). *i*-Propylbenzene was also reduced in the lithium-amine system, and 1-*i*-propylcyclohexene was identified in the reduction product.

Section B. The Mechanism of Reduction of Aromatic Compounds in the Lithium-Amine System. — The effect of base strength, temperature, and the presence of bulky substituents has been studied for the base catalyzed isomerization of olefins to their more thermodynamically stable isomers. The relative isomerizing abilities of the LiMeNH-MeNH_2 and $\text{NaNH}_2\text{-NH}_3$ systems were compared by isomerizing 1,4,5,8-tetrahydronaphthalene in these systems at -36°C . and -78°C . The sodium amide system isomerized the triene at -36° , but did not appreciably isomerize it at -78° as determined by U.V. spectra of the isomerization products. The lithium methyl amide system gives a fair degree of isomerization even at -78° and was more effective at -36°C . than the sodium amide system. Treatment of 3-methylcyclohexene with lithium methyl amide in methyl amine readily isomerized it to the more stable 1-olefin; under the same conditions 3-t-butylcyclohexene was not isomerized to the 1-olefin. The 1,4-reduction of conjugated dienes in the lithium-amine system has been demonstrated by the reduction of 2,3-dimethylbutadiene to 2,3-dimethyl-2-butene. 2,3-Dimethyl-1-butene was not isomerized to the 2-olefin under basic conditions comparable to those in the reduction mixture. These data further substantiate the mechanism of reduction of aromatic hydrocarbons in the lithium-amine system which has been briefly outlined previously. [R. A. Benkeser, et. al., *J. Am. Chem. Soc.*, **77**, 3230 (1955).] The data are also in accord with the published data on reductions with the sodium-ammonia system.

Section C. The Reduction and Subsequent Reactions of the Reduction Product from Fluorene. — The reduction of fluorene to 1,2,3,4-tetrahydrofluorene by lithium in methyl amine has been confirmed by comparison of the U.V. spectra of fluorene, indene, and 2,3-diethylindene. Oxidation of the reduction product with perbenzoic acid gave the benzoate half-ester of 1,2,3,4-tetrahydrofluorene glycol. Oxidation by performic acid unexpectedly gave a "trioxide" $\text{C}_{13}\text{H}_{16}\text{O}_3$ which was soluble in 5% NaOH. The "trioxide" was methylated to $\text{C}_{14}\text{H}_{18}\text{O}_3$ with MeI and NaOH and oxidized to $\text{C}_{13}\text{H}_{14}\text{O}_3$ with lead tetraacetate. Structures have been proposed for these compounds, based upon infrared spectra and qualitative tests. These structures and a proposed reaction mechanism have yet to be confirmed by further work at this Laboratory.

PART II

Two approaches were attempted in an exploratory study to find new methods of cyclic silane formation. The first was based on the known addition of chlorosilanes to olefins

under U.V. or peroxide catalysis. However, no more than trace amounts of dichlorosilacyclohexane were formed by a high dilution reaction of dichloro-1-pent-4-enylsilane under U.V. or peroxide catalysis. A solid polymer containing considerable Si-H bonding and starting silane (25%) were obtained. The addition reaction proceeded so slowly that the high dilution technique was ineffective; it is postulated that vinyl polymerization of the olefinic bonds is the most rapid reaction in the system.

The second approach to cyclic silane formation was the classical pyrolysis of a dicarboxylic acid to a cyclic ketone. A preliminary study indicated the feasibility of this method insofar as the stability of a tetra-alkylated silane was concerned: 4-trimethylsilylcyclohexene was oxidized to the glycol in 80% yield with performic acid, and the glycol was oxidized to β -trimethylsilyladipic acid with KMnO_4 in 75% yield. Pyrolysis in the presence of barium hydroxide gave 70% yield of 3-trimethylsilylcyclopentanone. Dimethyl-di-1-pent-4-enylsilane was prepared and oxidized to a glycolic oil; oxidation of this oil gave acidic oil which could not be purified. Further work will be carried out on this latter approach (and other methods) of cyclic silane formation at this Laboratory.

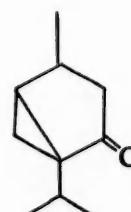
244 pages. \$3.15. Mic 57-2354

THE SYNTHESIS OF 4-ISOPROPYL-1-METHYLBICYCLO [3,1,0]-3-HEXENON-2

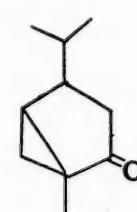
(Publication No. 20,467)

Howard Edward Smith, Ph.D.
Stanford University, 1957

The structure of umbellulone (I) has been confirmed by the unambiguous synthesis of an isomer, 4-isopropyl-1-methylbicyclo-[3,1,0]-3-hexenon-2 (II), which contains the same chromophoric system and has an ultraviolet absorp-

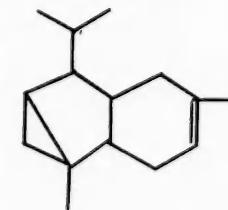


I



II

tion spectrum practically identical with the anomalous absorption spectrum reported for umbellulone ($\lambda \lambda_{\text{max.}}^{\text{alc.}} 216 \text{ m}\mu, 262, \text{ sh. } 320$). The synthetic material is also a reference material for the investigation of the mechanism of the thujone-isothujone transformation and an intermediate in a projected synthesis of copaene (III).



III

For the preparation of 4-isopropyl-1-methylbicyclo

[3,1,0]-3-hexenon-2, diazomethyl isopropyl ketone was condensed with methyl methacrylate to give after thermal decomposition of the intermediate pyrazoline a mixture of *cis* and *trans*-2-isobutyryl-1-methylcyclopropanecarboxylic acid methyl esters. This mixture was hydrolyzed with alkali to a syrupy mixture of *cis* and *trans*-2-isobutyryl-1-methylcyclopropanecarboxylic acids from which the *trans* isomer separated as a crystalline solid. After structure proof by oxidation to the known *trans*-1-methyl-1,2-cyclopropanedicarboxylic acid, *trans*-2-isobutyryl-1-methylcyclopropanecarboxylic acid was converted via reaction of its acid chloride with dimethyl cadmium to *trans*-1-acetyl-2-isobutyryl-1-methylcyclopropane which on treatment with dilute alkali underwent aldol cyclization via the *cis* diketone to yield 4-isopropyl-1-methylbicyclo 3,1,0 -3-hexenon-2.

97 pages. \$2.00. Mic 57-2355

REARRANGEMENT OF DIHYDROPYRAN OVER HOT ALUMINA

(Publication No. 21,748)

John Emerson Stouffer, Ph.D.
Boston University Graduate School, 1957

Major Professor: Associate Professor Walter J. Gensler

The mechanism of the unusual rearrangement of tetrahydrofurfuryl alcohol over alumina at an elevated temperature to give good yields of dihydropyran has been of considerable interest.

It had previously been shown that the external methylene carbon of tetrahydrofurfuryl alcohol was found, after ring expansion had taken place, not only at the 2 position of Δ^2 -dihydropyran as one might have expected, but in about half of the product at the 6 position instead. It then became important in terms of eventual assignment of a mechanism to this reaction, to determine if Δ^2 -dihydropyran, once formed, was itself capable of further rearrangement. The present research set out to establish whether or not this took place.

Δ^2 -Dihydropyran was synthesized with radioactive carbon-14 as a tracer in the 6 position, and this compound was passed over hot alumina under conditions similar to those used in the dehydration and ring expansion of tetrahydrofurfuryl alcohol. The Δ^2 -dihydropyran which was then recovered was subjected to a series of degradation reactions which split the original compound into various fragments. These derivatives were analyzed for radioactivity, and from the results obtained an assignment of the location of activity was made.

The method of synthesis of Δ^2 -dihydropyran-6-C¹⁴ consisted of the following. Tetrahydrofurfuryl chloride was prepared from tetrahydrofurfuryl alcohol by treatment with thionyl chloride in the presence of pyridine and then converted to 4-penten-1-ol by means of sodium. 1-Bromo-4-pentene, obtained from 4-penten-1-ol by reaction with phosphorus tribromide in the presence of pyridine, was then used to prepare the Grignard reagent with magnesium. Carbonation of the 4-pentenylmagnesium bromide with carbon dioxide-C¹⁴ followed directly by lithium aluminum hydride reduction of the resulting 5-hexenoic-1-C¹⁴ acid gave 5-hexen-1-ol-1-C¹⁴. Ozonolysis of the last compound

furnished 5-hydroxypentenal-5-C¹⁴, which on dehydration furnished the required Δ^2 -dihydropyran-6-C¹⁴.

Exposure of Δ^2 -dihydropyran-6-C¹⁴ to alumina at 350° gave rise to Δ^2 -dihydropyran consisting in part of molecules with activity at the 2 position and in part of molecules with activity at the 6 position.

The following sequence was employed in the degradation of Δ^2 -dihydropyran to determine the position of the radioactivity. Δ^2 -Dihydropyran was converted to its 2,4-dinitrophenylhydrazone derivative and subjected to a radioactivity analysis. The activity of this derivative then represented the total activity of Δ^2 -dihydropyran. Ozonolysis split the molecule into two fragments. One fragment was isolated as the 2,4-dinitrophenylhydrazone derivative of 4-hydroxybutanal. The activity in the compound represented the sum of the activity at the 3, 4, 5 and 6 positions of the original Δ^2 -dihydropyran. The fragment corresponding to the 2 position of Δ^2 -dihydropyran was isolated as the zinc formate derivative.

In addition, Δ^2 -dihydropyran was oxidized to glutaric acid. The activity of glutaric acid represented the sum of the activity of all the carbons in Δ^2 -dihydropyran. This acid was then decarboxylated by utilization of the Schmidt reaction and the resulting 1,3-diaminopropane isolated as the dibenzoyl derivative. The activity of this compound represented the total of the activity of the carbons at the 3,4 and 5 positions of Δ^2 -dihydropyran.

Δ^3 -Dihydropyran was then synthesized by preparing 4-acetoxytetrahydropyran by the Prins reaction of propylene with formaldehyde in the presence of acetic acid, followed by distillation from p-toluenesulfonic acid.

Δ^3 -Dihydropyran was passed over activated alumina at a temperature of 350° and underwent a reaction yielding a highly volatile material of unknown composition. No Δ^3 -dihydropyran was found to have been converted to Δ^2 -dihydropyran. This result shows that the rearrangement of Δ^2 -dihydropyran does not proceed via Δ^3 -dihydropyran as an intermediate.

130 pages. \$2.00. Mic 57-2356

STUDIES IN THE ISOLATION, DEGRADATION AND SYNTHESIS OF CERTAIN INDOLE ALKALOIDS

(Publication No. 21,230)

Charles William Taylor, Ph.D.
The University of Wisconsin, 1957

Supervisor: Associate Professor Eugene E. van Tamelen

The investigation of indole alkaloids described in this work is divided into three parts.

1. A model synthetic route to the yohimbine skeleton was investigated. The Michael product arising from the addition of ethyl-2-pyridylacetate to 1-cyanocyclohexene was transformed through a hydrolysis, reduction, and cyclization sequence to 11-azatetradecahydroanthracene, which constitutes the C-D-E ring system of the yohimbine skeleton. However, all attempts to adapt this route to the preparation of the pentacyclic indole system failed due to the reluctance of the harmyl anion to undergo Michael condensation with 1-cyanocyclohexene.

2. The weakly basic extracts from *Rauwolfia heterophylla* were chromatographed on acid-washed alumina

employing a gradient elution technique. In addition to the known alkaloids previously reported to be present in this species (aricine, ajmalicine, and reserpine), the alkaloids deserpidine, raunescine, and pseudoreserpine were isolated. Evidence for the presence of isoreserpiline was also obtained.

3. The isomeric indole alkaloids raunescine and isoraunescine were investigated. Spectral and analytical data revealed that these isomers are desmethyl deserpidines. Basic hydrolysis of both raunescine and isoraunescine afforded a single dihydroxyamino acid which proved to be identical with the dihydroxyamino acid obtained from hydrobromic acid cleavage of deserpidine. That no epimerization had occurred during basic hydrolysis was shown by reducing the lactone from the dihydroxyamino acid as well as raunescine and isoraunescine to the same triol with lithium aluminum hydride. This reduction also proved that raunescine and isoraunescine differ from one another only in the site of acylation with 3,4,5-trimethoxybenzoic acid, the ester function residing on C-17 in one isomer and on C-18 in the other. Since the stereochemistry of deserpidine had been established, relating raunescine and isoraunescine to this alkaloid defined the stereochemistry at carbon atoms 15, 16, 17, 18, and 20. That raunescine and isoraunescine also possess the less stable configuration at C-3 was shown by (i) their resistance to mercuric acetate oxidation, (ii) the facile lactonization of the dihydroxyamino acid, and (iii) infrared spectral data. Although the complete structure of the alkaloid obtained by removal of the 3,4,5-trimethoxybenzoyl group was established, no chemical evidence was obtained which would allow a choice to be made between the two possible isomeric structures for raunescine and isoraunescine.

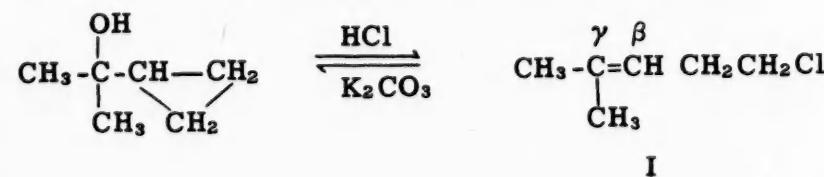
109 pages. \$2.00. Mic 57-2357

AN INVESTIGATION OF THE
UNCATALYZED ALKYLATION OF PHENOL
WITH 1-CHLORO-4-METHYL-3-PENTENE

(Publication No. 21,395)

Charles Roe Wagner, Ph.D.
Michigan State University, 1955

Braylants and Dewael¹ and later Favorskaya and Fridman² reported that 1-chloro-4-methyl-3-pentene (I) which was the product obtained when dimethylcyclopropylcarbinol was treated with hydrochloric acid, was converted back to dimethylcyclopropylcarbinol on treatment with base. It appeared that the β , γ -double bond participated in the

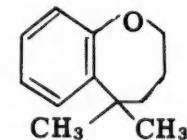


solvolytic reaction. One would conclude that I should be more reactive than most primary halides, being a potential source of a tertiary carbonium ion. It had previously been shown³ that tertiary halides, or other unusual reactive halides, such as allyl or benzyl halides, alkylate the aromatic nucleus of phenol without the need of the usual

Friedel-Crafts type of catalyst. Primary halides (other than allyl or benzyl) do not alkylate phenols without such a catalyst.

It was the object of this research, then, to determine whether the primary chloroolefin, 1-chloro-4-methyl-3-pentene, was sufficiently reactive to alkylate the nucleus of phenol without a catalyst, and if so, to determine the structure of the product; that is, to determine whether the alkyl group reverted to the dimethylcyclopropylcarbinyl form.

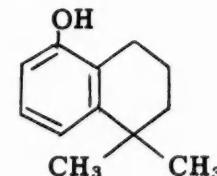
When I was heated with phenol at 150°, hydrogen chloride was evolved and two isomeric crystalline products were isolated. Neither of these was the expected *p*-dimethylcyclopropylcarbinyl phenol. One was an ether, to which the structure 5,5-dimethylhomochroman (II) was assigned. The elemental analysis and infrared and ultraviolet absorption spectra were consistent with this structure.



II

Furthermore, this ether was obtained when an authentic sample of 5-phenoxy-2-methyl-2-pentene, was treated with a few drops of sulfuric acid.

The second crystalline product was an alkylated phenol. A number of structures were considered and the one which was most consistent with the chemical and physical data was 1,1-dimethyl-5-tetralol (III). Further work is needed, before this structure assignment can be considered unequivocal.



III

When the ether (II) was refluxed with hydrobromic acid and acetic acid, a second crystalline alkylated phenol was obtained. The structure of this compound is not clear but it appears to be alkylated *para* to the hydroxyl group.

Since saturated primary alkyl halides did not evolve hydrogen chloride when heated with phenol at 150°, it can be concluded that the double bond of I is involved in this reaction, but from the structure of the products, it is likely that the mechanism is quite different from the hydrolysis of I to dimethylcyclopropylcarbinol.

During the course of these studies, several new compounds were synthesized, mainly for the purposes of comparison with the observed alkylation products. 2-Isopropylchroman was prepared by treating 1-(*o*-hydroxyphenyl)-4-methyl-3-pentanone with zinc dust and sulfuric acid. 5-Phenoxy-2-methyl-2-pentene was obtained by refluxing a mixture of phenol, 1-chloro-4-methyl-3-pentene, acetone and potassium carbonate. The structure of 5-phenoxy-2-methyl-2-pentene was proved by degradation to known compounds.

1-(*o*-Methoxyphenyl)-4-methyl-3-pentanone was prepared by the catalytic reduction of the known compound, *o*-methoxystyryl isopropyl ketone. Reduction of

1-*o*-methoxyphenyl)-4-methyl-3-pentanone with lithium aluminum hydride gave 1-(*o*-methoxyphenyl)-4-methyl-3-pentanol. 1-(*p*-Methoxyphenyl)-4-methyl-3-pentanone was prepared by the catalytic reduction of the known compound *p*-methoxystyryl isopropyl ketone. Reduction of 1-(*p*-methoxyphenyl)-4-methyl-3-pentanone with lithium aluminum hydride gave 1-(*p*-methoxyphenyl)-4-methyl-3-pentanol. Derivatives of the new ketones and alcohols were made.

Dimethylcyclopropylcarbonylbenzene was prepared by the following series of reactions. Reduction of the known compound, ethyl 2-carbethoxy-3-methyl-3-phenylbutanoate, with lithium aluminum hydride gave 2-hydroxymethyl-3-methyl-3-phenyl-1-butanol. Treatment of the diol with phosphorus tribromide gave 2-bromoethyl-3-methyl-3-phenyl-1-bromobutane. Ring closure with zinc dust gave dimethylcyclopropylcarbonylbenzene.

t-Butyl phenyl ether prepared from phenol and isobutylene, was split readily in benzene solution at 50° with hydrogen chloride. Cleavage, rather than rearrangement products were obtained.

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2. T. A. Favorskaya and Sh. A. Fridman, J. Gen. Chem., (U.S.S.R.), 15, 421 (1945); C. A. 40, 4655 (1946).
3. J. H. Simons and H. Hart, J. Am. Chem. Soc., 66, 1309 (1944). 109 pages. \$2.00. Mic 57-2358

CARBON BLACK IN THE OXIDATION OF GR-S VULCANIZATES

(Publication No. 20,947)

William T. Wickham, Jr., Ph.D.
Case Institute of Technology, 1956

The relation between rate of oxygen absorption of vulcanizates and carbon black content was studied for several different vulcanizate systems to investigate possible mechanisms of the action of carbon black in the oxidation of rubber.

The study indicated in individual cases both an increase and a decrease in rate of oxidation with increased carbon content, and a mutual lessening of the rate increasing effect of iron and carbon black when both were present. These findings are discussed in terms of known reactions of carbon black in the literature.

40 pages. \$2.00. Mic 57-2359

THE SYNTHESIS AND CHEMISTRY OF CERTAIN DERIVATIVES OF THE PERHYDROPYRIDAZO [1,2-a] PYRIDAZINE RING SYSTEM (PARTS I AND II)

(Publication No. 19,445)

John Ery Wyman, Ph.D.
Purdue University, 1956

Major Professor: Henry Feuer

The aim of this research was (1) to study the mode of formation of 1,2-dihydro-3,6-pyridazinedione (maleic hydrazide) by the reaction of maleic anhydride and hydrazine hydrate in glacial acetic acid solution, (2) to find a general method of synthesis of derivatives of the perhydropyridazo [1,2-a]pyridazine ring system, and (3) to study the chemistry of perhydro-1,4,6,9-tetraketopyridazo[1,2-a]pyridazine.

The reaction of maleic anhydride and hydrazine hydrate in glacial acetic acid solution at 40° yielded dimaleichydrazide diacid, and not N-aminomaleimide as previously claimed. This compound has been found to cyclize to maleic hydrazide and there is good evidence that hydrolysis of dimaleichydrazide diacid to the half hydrazide of maleic acid, preceded cyclization. The reaction of maleic anhydride and hydrazine hydrate in ethanol solution at 40-45° afforded a mixture of dimaleichydrazide diacid and a hydrazine-maleic anhydride complex. No evidence was obtained to indicate that N-aminomaleimide was formed.

The preparation of derivatives of the perhydropyridazo [1,2-a]pyridazine ring system by the reaction of substituted succinyl chlorides with perhydro-3,6-pyridazinediones cannot be employed as a general method of synthesis; when succinyl chloride was replaced by phthalyl chloride a disproportionation reaction leading to the formation of 2,3-dihydro-1,4-phthalazinedione and 5,7,12,14-tetraketophthalazo[2,3-b]phthalazine was observed. Similarly, perhydro-3,6-pyridazinedione and maleic anhydride gave a disproportionation reaction with the formation of maleic hydrazide. However, the thermal or polyphosphoric acid dehydration of substituted succinic acids and hydrazine hydrate in a 2:1 molar ratio has been found to lead to excellent yields of alkyl and aryl derivatives of perhydro-1,4,6,9-tetraketopyridazo[1,2-a]pyridazine. This procedure also has its limitations since diacetyltauric, aspartic, N-acetylaspartic, malonic and dibromosuccinic acids all failed to undergo the cyclization reaction. Comparison of the infrared spectra of these materials with those of model compounds indicates that the assignment of the perhydro-pyridazo-[1,2-a]pyridazine ring structure is correct.

The chemistry of perhydro-1,4,6,9-tetraketopyridazo [1,2-a]pyridazine was studied as a model for the system. It was found to be resistant to bromination under all conditions that were employed. It did not react with phosphorous pentachloride nor did it undergo catalytic hydrogenation indicating a low order of reactivity of the carbonyl groups. It reacted with hydrazine hydrate to give succin-dihydrazide by ring opening and was reduced by lithium aluminum hydride to perhydropyridazo[1,2-a]pyridazine, characterized as a picrate and an oxalate derivative.

175 pages. \$2.30. Mic 57-2360

THE DECOMPOSITION OF
2-(4'-METHYLBENZOYL) BENZENE-
DIAZONIUM BISULFATE IN METHANOL
CONTAINING AN ACETATE BUFFER

(Publication No. 21,510)

Benjamin DeLaney Wyse, Jr., Ph.D.
University of South Carolina, 1957

The decomposition of 2-(4'-methylbenzoyl)benzenediazonium bisulfate in methanol containing an acetate buffer has been studied in an effort to determine more of the details of the homolytic cleavage of the carbon-nitrogen bond.

The decomposition of benzenediazonium salts in methanol containing an acetate buffer and in the absence of oxygen is best described by a free radical chain reaction. It was expected that the decomposition of 2-(4'methylbenzoyl)-benzenediazonium bisulfate would be analogous under similar reaction conditions.

In the presence of iodine, which is an effective radical trap, the chain carrying steps for the homolytic decomposition of 2-(4'-methylbenzoyl)benzenediazonium bisulfate might be eliminated. The rate of the initiation step of the free radical reaction would then be the rate of evolution of nitrogen from the diazonium salt.

Three sets of kinetic experiments were designed to determine the effect of buffer ratio, iodine concentration, diazonium salt concentration, and acetate ion concentration on the rate of reaction. In these experiments the presence of iodine retarded the overall rate of reaction and the rate of nitrogen evolution was accurately first-order. The most important factor that affected the rate was the buffer ratio. Of the other three variables only iodine had an effect on the rate of reaction. This indicates that iodine is not serving primarily as an inhibitor.

The observed first-order rate constant could be partitioned into three terms as follows:

$$10^4 k = 1.82 + 0.17(\text{NaOAc})/(\text{HOAc}) + 25.0(\text{I}_2)(\text{NaOAc})/(\text{HOAc})$$

This equation summarizes all of the rate constants within the overall standard deviation of the rate constants.

At the present time it is not possible to give a complete account of the reaction mechanism, but the possible relevance of each of the terms in the above equation has been examined. The reaction of diazonium salts with iodine is complicated and the use of iodine as a radical trap does not appear to be a promising approach.

The main product of the reaction in the presence of iodine is 2-iodo-4'-methylbenzophenone. Also produced by the reaction is an unknown compound (unknown #35) and a small amount of 3-methylfluorenone. Unknown #35 has several unusual characteristics, among which are, an empirical formula ($C_{18}H_{22}O_5I_2$) which is difficult to account for and an infrared curve which contains a peak at $5.68\ \mu$, which is in the carbonyl absorption range but which is unusually low for a carbonyl group.

For the decomposition of 2-(4'-methylbenzoyl)benzenediazonium bisulfate in methanol containing an acetate buffer and in the absence of oxygen, the rate is dependent on the diazonium salt concentration and the buffer ratio. This reaction may be described by a free radical chain process which leads to first plus half-order kinetics. The overall kinetic results as well as the points within a given run are consistent with this view. A preliminary study of the reaction products showed that 4-methylbenzophenone is the

main product. Some 3-methylfluorenone is also produced in the reaction. The small amount of 3-methylfluorenone produced may be attributed to an accompanying ionic reaction. The reduced product (i.e. 4-methylbenzophenone) is the expected product for the free radical chain mechanism.

148 pages. \$2.00. Mic 57-2361

CHEMISTRY, PHARMACEUTICAL

A PRELIMINARY PHYTOCHEMICAL
INVESTIGATION OF DIGITALIS
LUTEA FIRST YEAR GROWTH

(Publication No. 21,239)

Jack Robert Cole, Ph.D.
University of Minnesota, 1957

Major Adviser: O. C. Gisnald

The phytochemical investigation of the fresh leaves of the first years growth of Digitalis lutea was limited to a partial examination of extracts prepared by two different techniques. The first method consisted of the preparation of an aqueous and alcoholic-aqueous extracts, and subsequent selective organic solvent extraction of the aqueous extracts. The use of 15% alcohol in the preparation of the primary extract had a distinct effect on the prevention of emulsification. The crude extractives and further purified materials were subjected to examination by paper chromatography. Descending, ascending and horizontal chromatography was employed. Several known solvent systems were employed as well as new modifications when conditions warranted. This analysis indicated the presence of acetyl digitoxin, digitoxin, and acetyl digoxin. A system of deacetylation and hydrolysis of these glycosides followed by paper chromatographic analysis was used to prove their presence. For these reactions, a new method involving the use of ion exchange resins was developed. A strong basic resin was used for deacetylation and a strong acid resin was used for the hydrolysis.

A comparison of the extraction of fresh leaves and frozen leaves was made. The results indicated that the freezing process employed was efficient and that essentially no changes occur during the storage period.

The second extraction method used was an enzyme-inhibitory extraction. The material obtained from this extraction was subjected to paper chromatographic analysis using different solvent systems from those used previously. This material indicated the presence of Lanatosides A, B and C. Lanatosides B and C were only detectable in very small amounts. This extraction method suggests the possibility that during the first extraction method described some enzymatic hydrolysis had taken place and that the digitoxin and digoxin glycosides were hydrolysis products of the Lanatosides.

A column chromatographic analysis was attempted. This resulted in only a partial separation of the glycosides.

The saponins of the plant were also investigated by means of paper chromatography. They were extracted with n-butanol. During this extraction some butanol soluble

glycosides were detected. These were found to be glycosides missed by previous extractions. The saponins were hydrolyzed and saponins isolated and paper chromatographed. Several new solvents systems for the paper chromatography of the saponins were developed. These new systems as well as other known systems indicated the presence of tigogenin and gitogenin.

A mild sulfuric acid hydrolysis of the saponins followed by paper chromatographic investigation indicated the presence of D-galactose, D-glucose and D-xylose.

107 pages. \$2.00. Mic 57-2362

CHEMISTRY, PHYSICAL

THE THERMAL ACCOMMODATION OF HELIUM AND NEON ON BERYLLIUM

(Publication No. 21,099)

Robert Eugene Brown, Ph.D.
University of Missouri, 1957

Supervisor: Dr. Lloyd B. Thomas

The thermal accommodation coefficient (AC) is the average efficiency of the energy exchange at a gas-solid interface. The AC is usually measured by determining the heat conducted by a gas at low pressure from an electrically heated filament and comparing this with the heat conduction calculated from kinetic theory. Since the AC is greatly dependent upon the condition of the surface of the metal filament, considerable care must be exercised to assure that the surface is free of adsorbed gases.

Measurements were made at room temperature of the AC of helium and neon on a freshly formed beryllium surface. Beryllium surfaces were formed by evaporation of the metal onto a tungsten filament. The AC of helium on freshly evaporated beryllium was .145 and of neon .315. These values are probably somewhat too high because roughness of the surface of the beryllium layer enhances the energy exchange. An attempt was made to sinter the beryllium deposit into a smooth coherent coating by heating the filament to 850° C. The AC of helium was reduced to .04 by this treatment, but there is some doubt that the filament retained a complete covering of beryllium.

Experimental data for the gases helium and neon and the metals beryllium, aluminum and tungsten were found to be in disagreement with the Baule theory. It appears that the energy exchange at a gas-solid interface cannot be explained in a classical way. The Jackson-Mott formula, derived by quantum mechanical methods and assuming a rigid elastic sphere interaction for the atoms, seems to be closer to the truth although it gives too high a value for the AC.

Devonshire's formula for the AC contains the two constants of the Morse potential function, which he assumed to describe the interaction of the gas and solid atoms. These constants were adjusted to secure calculated values of the AC agreeing with Silvernail's data for helium and neon on tungsten. Values of the AC for helium and neon on beryllium, aluminum, iron and platinum were calculated by

assuming that the tungsten-gas interaction potential was the correct one for these metals also. These calculated values of the AC agreed rather well with the experimental data except in the case of beryllium. It appears that the beryllium-gas interaction potential may be somewhat different than that of the other metals. So long as one may assume a constant metal-gas interaction potential, the AC of a given gas appears to be nearly proportional to $1/M\Theta^3$, M being the atomic weight of the metal and Θ its Debye characteristic temperature.

86 pages. \$2.00. Mic 57-2363

THE REACTIONS OF THE DIPHENYLIODONIUM ION WITH PHENOXIDE AND HYDROXIDE IONS

(Publication No. 21,416)

Ezekiel Melvin Gindler, Ph.D.
Polytechnic Institute of Brooklyn, 1957

The object of this dissertation is to investigate the rates and mechanisms of the reactions of the diphenyliodonium cation with phenoxide and hydroxide ions.

Kinetic expressions are developed for a system in which free ions are in equilibrium with ion pairs, which may collapse irreversibly to products. If the concentration of such ion pairs is substantial, even at constant ionic strength the experimental second-order rate constant (k_2) depends on the concentrations of the reactants.

$$k_2 = \frac{Kk}{1 + K(a+b-c)}$$

Here K is the equilibrium constant for ion pair formation, k is the rate constant for the irreversible decomposition of ion pairs to products, a and b are the stoichiometric concentrations of the reacting cation and anion, and c is the concentration of ion pairs. As the concentration of ion pairs decreases, k_2 becomes independent of reagent concentrations, and its behavior may approach that predicted by the Debye-Hückel limiting law.

The various equations developed here are applied to the study of the reaction of diphenyliodonium and phenoxide ions to give diphenyl ether and iodobenzene. This reaction has been found to be of second-order in most dioxane-water mixtures, with the order decreasing at high dioxane concentrations. Peroxides, in low concentration, do not seem to affect the reaction with phenoxide ion. In 1:1 dioxane-water at 45-70°, k_2 gave Arrhenius parameters $\log PZ = 12.8$ (PZ in liter/mole-sec.) and $E_a = 25.9$ kcal./mole. At 65.1° a plot of $\log k_2$ vs. $u^{0.5}$ (u = ionic strength) had a slope of -2.7, while with u constant, $\log k_2$ varied linearly with $1/D$ (D = dielectric constant).

At constant u , D and T variation of k_2 with reagent concentrations allowed calculation of the association constant for the formation of the yellow diphenyliodonium phenoxide ion pair and the rate constant for the irreversible decomposition of the ion pair to products under a variety of conditions.

The reaction between diphenyliodonium and hydroxide ions in 1:3 dioxane-water is kinetically second-order and measurable in the absence of peroxides. In the presence of peroxides the reaction is erratic and very rapid after a brief induction period. In 1:1 dioxane-water the reaction

is extremely sensitive to the presence of peroxides but may be made measurably slow by the addition of allyl alcohol.

In 1:3 dioxane-water, at an ionic strength of 0.13, the Eyring rate equation parameters were $\Delta H^\ddagger = 28.8$ kcal./mole and $\Delta S^\ddagger = 20.1$ e. u. for the hydroxide reaction; and $\Delta H^\ddagger = 24.7$ kcal./mole and $\Delta S^\ddagger = 0.6$ e. u. for the phenoxyde reaction.

83 pages. \$2.00. Mic 57-2364

**THE ENZYMATIC SYNTHESIS OF DEXTRAN
(PARTS I AND II)**

(Publication No. 18,348)

Albert Goodman, Ph.D.
Polytechnic Institute of Brooklyn, 1956

A study was made of the enzymatic synthesis of dextrans with the hope that it would shed light on the mechanism of this polymerization and also lead to a better understanding of other polymerizations in nature. The enzyme, dextranase, was produced from cultures of the B-512 strain of the bacterium Leuconostoc mesenteroides. An investigation of the factors which influence the production of this enzyme revealed that optimum yields could be obtained with media containing 3 per cent sucrose, and 0.5 per cent yeast extract. The optimum temperatures of the fermentation, the preparation of the inoculation, the concentration of inorganic ions, and the pH of the medium were all found to influence the yield of the enzyme. Methods for purification of dextranase were worked out. Highly purified preparations were made by alcohol fractionation of the culture medium after the cells were removed by centrifugation, and by adsorption of the enzyme on calcium phosphate gels.

A study was made of the rate of the enzymatic polymerization of sucrose to dextran. It was found that the kinetics could be expressed by the classical Michaelis-Menten equation for enzymatic reactions:

$$V_{\text{rel}} = \frac{V_{\text{max.}} (S)}{(S) + K_M}$$

The effect of the temperature upon the rate of reaction revealed a value of 10.8 kcal/mole for the Arrhenius Activation Energy. The heat of reaction, ΔH , entropy change, ΔS , and change in Gibbs free energy, ΔF , for the formation of an intermediate complex were evaluated by ratios of the velocities at low and high substrate concentrations. An alternate method for arriving at these quantities, which depended upon the measurement of Michaelis constants at different temperatures, was introduced.

The physical properties of the polymer produced enzymatically were studied. These investigations revealed that the molecular weight, intrinsic viscosity, and ratio of branching could be altered by changing the substrate concentration, reaction temperature, and enzyme concentration. The molecular weight of the polymer was found to increase with reaction temperature while the intrinsic viscosity decreased. This was explained on the basis of increased branching of the polymer chains. The decrease in molecular weight with enzyme concentration was described on the basis of a chain reaction in which the increased catalyst initiated a larger number of chains at higher

concentrations. The decrease in molecular weight of the dextran at higher concentrations of sucrose was also explained by analogy with the treatment for vinyl polymerizations, in which the enzyme is complexed with the polymer and chain transfer occurs more easily to the smaller molecules.

A study of the mechanism of dextran formation with the use of radioactive tracers and paper chromatography revealed that the solvent, water, was a chain acceptor and produced glucose as a by-product of the reaction. The addition of radioactive low molecular weight polymer to the reaction resulted in chain transfer to these molecules, with the formation of dextrans which contained radioactive units on one end. From measurements of the specific activity of the final product, molecular weights of the polymer could be directly calculated.

In general, it was concluded that the formation of dextran can be treated as a modified chain reaction in which a glucose residue from the substrate attacks a suitable acceptor molecule to form a new glucopyranose bond. The rate controlling step in this reaction was found to be the splitting of the sucrose molecule.

204 pages. \$2.65. Mic 57-2365

**EQUILIBRIA-TEMPERATURE DATA FOR THE
WATER-PHENOL-o-CRESOL SYSTEM**

(Publication No. 20,940)

Harold Benne Kendall, Ph.D.
Case Institute of Technology, 1956

The water-phenol-o-cresol system was studied at 30°, 60°, 73° and 100°C. At each of these temperatures the compositions of the liquid phases existing at equilibrium were determined. The analysis of the water content by a "salting-out" method was found to be reliable over the entire range of compositions, but the determination of the phenol to o-cresol ratio was not sensitive where the water content was greater than 60 per cent (by weight). The composition of the ternary vapor in equilibrium with the liquid phases was found by employing activity coefficients determined in the binary systems: phenol-water, o-cresol-water, and phenol-o-cresol.

74 pages. \$2.00. Mic 57-2366

**AN INVESTIGATION OF THE EFFECT OF
X-RAYS ON THE RESIDUAL CURRENT**

(Publication No. 21,766)

Solomon Levinson, Ph.D.
New York University, 1957

Adviser: Professor Seymour Z. Lewin

This investigation of the effect of x-radiation on the residual current was undertaken as part of a study of the potentialities inherent in the application of coulometry as a dosimetric technique.

The residual current in water was studied in the

absence of radiation as a function of applied voltage and time. The slope of the current-voltage curve was found to increase exponentially up to the decomposition voltage of water in a manner described by the Tafel equation.

When water and aqueous solutions were irradiated by polychromatic x-rays, the residual current was found to increase with time at a rate that is directly proportional to the radiation intensity. This rate of increase diminished with time and was found to depend on the nature of the solute or dissolved gas. Solutes that are known to decrease or increase the yield of hydrogen peroxide were found to decrease or increase this rate of current rise. When the x-ray beam was turned off, the current did not immediately return to its pre-irradiation value but did so slowly, and at a rate which depended on the absorbed dose. The rate of current increase was found to depend on the nature of the electrode material but not on the distance between the electrodes. The rate of increase of the radiation-induced current was found to go through a maximum well below the decomposition voltage of water. Stirring of the water was found to increase the residual current, more markedly during and immediately subsequent to irradiation than before irradiation.

These experimental results could be accounted for and correlated by assuming that the residual current is due to electrolysis of water and is limited by chemisorption of one or more species at anode or cathode or both. Thus, the magnitude of the current which flows is determined by the amount of polarization of the rate-determining electrode. This in turn is determined by the amount of depolarization which is taking place due to desorption of the adsorbed products, or due to dissolution in the solid and liquid phases. Electron transfer may also take place directly across the adsorbed layers at sufficiently high applied voltages.

At the anode the adsorbed species may be OH radicals or products derived from them such as hydrogen peroxide, oxygen and HO_2^- . At the cathode the adsorbed species may be hydrogen atoms, or species derivable from them such as hydrogen, HO_2 , and H_2^+ .

The effect of x-radiation is to generate species which can react with the above-named entities, thereby aiding in the depolarization of the electrode surface(s). This depolarization allows more electrolysis to take place, thus increasing the current. This accounts for the direct proportionality observed between the rate of current rise and the x-ray intensity.

The initial rate of current rise, for a given x-ray flux, has been shown to increase with polarizing voltage and to go through a maximum well below the decomposition potential of the solution. At low applied voltages, the rate at which the electrode surface repolarizes itself might be expected to be more rapid, the higher the applied voltage. However, when the voltage has been increased sufficiently, the surface has become so leaky that depolarization of the surface does not significantly increase the current. Thus the effectiveness of the x-radiation in increasing current flow becomes progressively less. With further increase in the applied voltage, no increase in the residual current was obtained within the experimental error.

The initial rate of current increase has been found to be approximately independent of the amount of previous exposure. This indicates that under the conditions employed, the electrode surfaces had been only slightly depolarized.

An improved method for the quantitative determination of micromolar concentrations of hydrogen peroxide has been described.

110 pages. \$2.00. Mic 57-2367

THERMODYNAMIC PROPERTIES OF COMPLEXES ASSOCIATED WITH PROTEIN-HISTAMINE-ANTIHISTAMINE INTERACTIONS

(Publication No. 21,756)

Thomas Daniel Lyons, Ph.D.
Kansas State College, 1957

Although the literature describing the synthesis and pharmacological properties of antihistamine compounds is voluminous, there has been little attention given to the study of physical chemical properties of these substances. Since it is believed that the elucidation of the mechanism of action of these drugs must finally rest with the physical chemical nature of the molecules, this research was conducted to provide some fundamental physical chemistry data on histamine-antihistamine-protein interactions.

The thermodynamics of complex formation for a series of commercial antihistamines with metallic ions were evaluated by a potentiometric technique. The stabilities of these complexes were less than the corresponding histamine complexes. Of possible significance, however, was the fact that all complex stabilities involving a particular metallic ion were very nearly equal for all commercial antihistamines studied. This was interpreted as a partial requirement for antihistamine activity.

The potentiometric technique was also used to evaluate the thermodynamics of polypeptide complexes with metallic ions. Possible structures for these complexes were postulated from comparisons of stability constant magnitudes.

The site of histamine binding to a protein has long been the subject of speculation. Repeated experiments have shown that histamine does not form a stable complex with native animal proteins *in vitro*. In this work a site has been provided on the protein capable of forming a stable complex with either histamine or the commercial antihistamine, Antistine. By the technique of equilibrium dialysis, the modified protein, bovine plasma albumin-Cu(II), was shown to bind a maximum of three moles of histamine per mole of protein at a pH of 6.95. This binding was shown to increase with an increase in pH; the protein binding a maximum of 20 moles of histamine per mole of protein at a pH of 8.90. The protein bound a maximum of two moles of Antistine per mole of protein.

The free energy of formation at 0.0°C . for the bovine plasma albumin-Cu(II)-histamine complex was found to be -0.87 Kcal at a pH of 6.90 for the first mole bound. The corresponding value for Antistine was very nearly the same. Thus, the mechanism of antihistamine action may be one of replacement of the toxic histamine molecule by a non-toxic antihistamine molecule on the protein surface.

105 pages. \$2.00. Mic 57-2368

**A STUDY OF THE ELECTROVISCOSUS EFFECT
IN SYNTHETIC RUBBER LATEX**

(Publication No. 21,658)

Robert A. Mendelson, Ph.D.
Case Institute of Technology, 1956

A dilute synthetic rubber latex has been studied at 30° C in order to ascertain the effect of the electrical charge carried by the rubber particles upon the viscosity of the system. The variables investigated were rubber concentration and soap content both in absence and in presence of added electrolyte.

It was found that the dependence of the viscosity on volume fraction of rubber at each soap content could be expressed by a modified Eilers equation. From the parameters of this equation could be calculated the first and second coefficients of a power series expression for the specific viscosity as a function of volume fraction. The first of these coefficients represents the reduced viscosity of the latex at infinite dilution.

In the absence of added electrolyte and at soap contents less than necessary for surface saturation, the first coefficient of the power series was found to decrease with increasing soap content and to approach the theoretical Einstein limit of 2.5 at soap contents near surface saturation. This behavior, for finite concentrations, is shown to be consistent with the concept of an electrokinetic potential occurring at distances from the particle surface greater than 1A. At soap contents above surface saturation the limiting reduced viscosity values increased, reaching 3.0 at the highest soap content. Explanation of the flow behavior of the system in this region is complicated by the presence of soap micelles.

In line with present theory, the limiting reduced viscosities were found to decrease with increasing concentration of added electrolyte. A similar behavior was found also for the second coefficient. However, at high added electrolyte concentrations the limiting reduced viscosities were found to fall below the expected value of 2.5. The latter effect is thought to be due to a reduction of the hydrodynamic volume occupied by the adsorbed monolayer of soap at high electrolyte concentration.

87 pages. \$2.00. Mic 57-2369

STUDIES IN MOLECULAR STRUCTURE

(Publication No. 21,299)

George Boehm Miller, Ph.D.
Purdue University, 1957

Major Professor: Walter F. Edgell

The microwave spectrometer originally constructed in this laboratory has been redesigned in order that it can be used not only as a survey instrument but also as a machine capable of high resolution and sensitivity. The basic system is outlined and pertinent design considerations are discussed. A detailed description of the circuitry and equipment employed in the revised instrument is given.

The microwave spectra of methylfluoroform and its deuterated derivatives have been investigated in the K-band

region. The frequencies of the R-branch transitions in all four molecules are given and an extensive number of Q-branch frequencies corresponding to series in which $J \geq 9$ are reported, but not specifically identified, for the asymmetric top molecules. Moments of inertia have been evaluated and a molecular structure consistent with these data has been calculated assuming a rigid rotor model and also that C-H = C-D and τ CCH = τ CCD.

143 pages. \$2.00. Mic 57-2370

**STANDARD HEATS OF FORMATION BY
ROTATING AND STATIONARY BOMB
CALORIMETRY (CF₄, CF₃H, CF₂H₂, CCl₃F,
CCl₄, C₂F₄, C₂F₂H₂, ClO₃F, COF₂, AlN)**

(Publication No. 21,224)

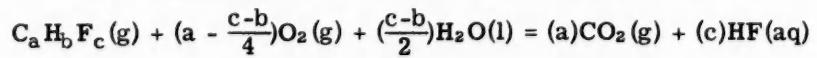
Constantine A. Neugebauer, Ph.D.
The University of Wisconsin, 1957

Supervisor: Assistant Professor John L. Margrave

Not many reliable data are available on the thermal stabilities and heats of formation of gaseous fluorocarbons, because of the difficulties involved at ordinary pressures in making the particular fluorocarbon undergo a well defined reaction whose heat could be measured. In order to force the formation of products in well defined thermodynamic states, a bomb calorimeter was employed exclusively in this investigation, allowing an initial pressure of the reagents involved of 30 atm or higher.

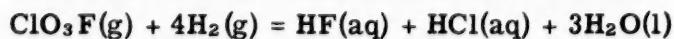
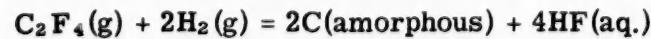
In order to achieve the maximum accuracy attainable with the bomb calorimeter if a solution phase is present (aqueous HF), it proved advantageous to construct a device which would allow the bomb to rotate after the initiation of the reaction. This not only insured a uniform concentration of the aqueous phase throughout, but also allowed the gaseous phase to reach equilibrium quickly with the dissolved species in solution, and greatly speeded up the heat exchange between the pool of solution inside the bomb and the calorimeter proper.

The generally most useful reaction whose heat was easily measurable was the combustion of the particular gaseous fluorocarbon in oxygen in the presence of water:



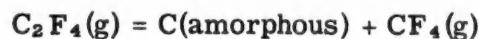
The standard heats of formation of gaseous CH₂F₂, CHF₃, and CH₂CF₂ at 25° C were determined according to this scheme, and they were -105.50 ± 0.22 , -162.6 ± 0.6 , and -77.7 ± 0.8 kcal/mole, respectively.

The heat of hydrogenation in the gaseous phase was used to determine the standard heats of formation of gaseous C₂F₄ and ClO₃F:



They were -151.9 ± 1.1 , and -5.1 ± 0.7 kcal/mole, respectively.

The heat of formation of CF₄ was calculated from the heat of the reaction



It was -217.2 ± 1.2 kcal/mole.

From this value of the standard heat of formation of CF_4 , and the heat of the reaction



which was available in the literature, the heat of formation of gaseous COF_2 was calculated as -143 kcal/mole.

By measuring the heat of the displacement of the carbon atom in CCl_4 and CCl_3F with magnesium in the presence of hydrogen (to prevent the formation of chlorine gas), producing carbon, magnesium halide, and $HCl(g)$, the heat of formation of these two compounds was evaluated. They were -32.3 kcal/mole for liquid CCl_4 , and -66.2 kcal/mole for gaseous CCl_3F .

Finally, because of the wide spread for the values of the heat of formation of solid AlN in the literature, it was determined from the direct nitridation of aluminum powder in 30 atm of nitrogen. The heat obtained was -76.47 ± 0.20 kcal/mole.

Only CH_2F_2 and CHF_2 were determined in the rotating bomb calorimeter; the conventional stationary bomb was used for the rest. All corrections for the Newtonian heat exchange, the heat of rotation, and the corrections to standard states were applied.

When the heats of atomization of the fluoromethanes and fluoroethylenes are plotted versus the fluorine content, it is found that the fluoromethanes are less stable than expected from a straight linear interpolation between CH_4 and CF_4 , while the fluoroethylenes appear to be more stable than predicted. This behavior can be explained on the basis of bond distance data, which indicate resonance contributions made by polyfluoromethanes, and a stronger C - F bond in fluoroethylene than in tetrafluoroethylene.

131 pages. \$2.00. Mic 57-2371

**STUDIES IN MOLECULAR SPECTROSCOPY:
SYNTHESIS OF ALKYL AND SUBSTITUTED
ALKYL FLUORIDES FROM
p-TOLUENESULFONIC ACID ESTERS
THE PREPARATION OF p-TOLUENESULFONIC
ACID ESTERS OF LOWER ALCOHOLS AND
SYNTHESIS OF METHYL-d₃ ALCOHOL
AND METHYL-d₃ FLUORIDE AND THE
VIBRATION-ROTATIONAL SPECTRUM
OF METHYL-d₃ FLUORIDE**

(Publication No. 18,886)

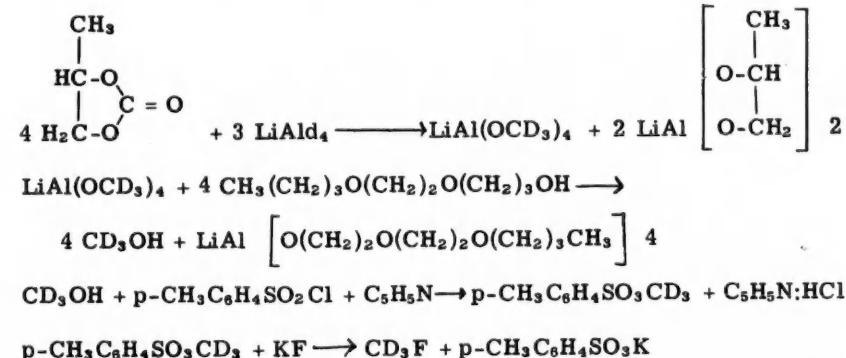
Leo Parts, Ph.D.
Purdue University, 1956

Major Professor: Walter F. Edgell

The reaction of p-toluenesulfonic acid esters with potassium fluoride has been developed to constitute a convenient laboratory preparation of alkyl and substituted alkyl fluorides. Isomerization, extensive elimination and doubling of chain length are not encountered in this preparative method. The following fluorides were prepared: CH_3F , C_2H_5F , $n-C_3H_7F$, $iso-C_3H_7F$, $n-C_7H_{15}F$, CH_2FCH_2F , CH_2ClCH_2F , CH_2BrCH_2F , CF_3CH_2F and $C_2F_5CH_3F$.

The mechanism of p-toluenesulfonic acid ester (tosylate) formation in tertiary amine solutions was studied briefly. The tosylates which react rapidly with pyridine at $0^\circ C$ may be prepared conveniently and in high yields at lower temperatures.

Methyl-d₃ fluoride was prepared by the following scheme of reactions:



The vibration-rotational spectrum of CD_3F was studied in the region $880-3420$ cm^{-1} . The observed fundamentals, overtone and combination bands have been assigned. The Coriolis coupling constants for the three doubly degenerate modes of vibration have been determined from the Q subband spacings of perpendicular bands. A set of five force constants was calculated for CD_3F , and CH_3F , in terms of a modified valence force field potential function.

163 pages. \$2.15. Mic 57-2372

**THE CURRENT EFFICIENCY OF
MAGNESIUM ANODES**

(Publication No. 20,944)

Edson Herbert Phelps, Ph.D.
Case Institute of Technology, 1956

Electrode potential measurements, hydrogen evolution measurements, weight loss determinations and the rotogenerative method of detecting corrosion currents were used to study the corrosion of magnesium in sodium chloride solutions. The results obtained were explained by the view that the major anode reaction of magnesium consists of magnesium entering the solution as monovalent magnesium ions, a portion of which react with the solution to form divalent magnesium ions and hydrogen gas. This view indicates why the current efficiency of magnesium anodes are approximately 50% as a maximum when based upon the magnesium corroding directly to form divalent magnesium ions.

103 pages. \$2.00. Mic 57-2373

**THE CRYSTAL STRUCTURE
OF TITANIUM TRICHLORIDE**

(Publication No. 21,448)

John Waller Reed, Ph.D.
The Ohio State University, 1956

Single crystals of titanium trichloride were prepared by sublimation and mounted for x-ray investigation. The

reciprocal lattice was investigated by means of Weissenberg photographs. The reflections are of two types: ordinary Laue-Bragg spots and diffuse streaks parallel to a common (c) axis. Two reciprocal lattices may be defined: one which includes all reflections, corresponding to a large unit cell; and one which includes the Laue-Bragg spots alone, corresponding to a small unit cell.

The small unit cell was found to belong to the trigonal space group $P\bar{3}ml$, and the lattice constants, determined by a least-squares adjustment of data from a single crystal, are

$$\begin{aligned}a &= 3.556 \pm 0.001 \text{ \AA}, \\c &= 5.872 \pm 0.001 \text{ \AA}, \\z &= 2/3 \text{ molecule per unit cell.}\end{aligned}$$

Intensities of the Laue-Bragg reflections were obtained visually from Weissenberg photographs and were corrected to give observed values of the squares of the structure factors $|F_o|^2$.

A structure was found which accounted for the Laue-Bragg intensities alone. It was shown that this structure must be that of the average small unit cell; that is, the average of all of the small unit cells of the crystal, which are not necessarily all alike. This average small unit cell consists of

$$\begin{aligned}2/3 \text{ Ti at } 0, 0, 0; \\2 \text{ Cl at } 1/3, 2/3, z; 2/3, 1/3, \bar{z}; \\z = 0.235 \pm 0.002.\end{aligned}$$

(The structure was deduced from a Patterson section and confirmed by calculation of structure factors F_c and a Fourier section.)

It was shown that the over-all structure consists of infinite layers normal to the c axis one unit cell thick, all the cells of a layer being identical. The layers are compound layers, consisting of a layer of titaniums in the octahedral holes between two close-packed layers of chlorines. The layers are of three types, A, B, C. The unit cells describing them have $a = 6.158$, $c = 5.872$, $z = 2$, and the atomic positions are

$$\begin{aligned}\text{A: Ti at } 1/3, 2/3, 0; 2/3, 1/3, 0; \\\text{B: Ti at } 0, 0, 0; 2/3, 1/3, 0; \\\text{C: Ti at } 0, 0, 0; 1/3, 2/3, 0; \\\text{All: Cl at } 0, 1/3, z; 2/3, 2/3, z; 1/3, 0, z; \\1/3, 1/3, z; 0, 2/3, z; 2/3, 0, z; z = 0.235.\end{aligned}$$

The stacking of these layers in the direction of the c axis is not regular. The chlorine positions are the same for all layers, so that the chlorines are hexagonal close-packed, whatever the order of stacking. The disorder is due, therefore, to the titaniums alone. It is proposed that the layers tend to build up in the order ABAB (or the equivalent BCBC or CACA) but that random errors occur in the stacking, giving rise to the diffuse reflections.

155 pages. \$2.05. Mic 57-2374

FLOW OF NON-NEWTONIAN FLUIDS AT LOW SHEAR RATES

(Publication No. 20,946)

Arthur W. Sisko, Ph.D.
Case Institute of Technology, 1956

PART I

The generalized flow theory of Ree and Eyring has been applied to the data of Maron and Belner on the flow behavior of X-667 latex at low rates of shear in both the Newtonian and non-Newtonian regions. Whereas in the intermediate flow region, Maron and Pierce were able to represent the results in terms of two flow units, three such units were required at the low shear rates. These were a Newtonian water unit, and two latex flow units of different relaxation times. As a result, the dependence of viscosity on rate of shear, at any given concentration in the non-Newtonian range, required five parameters for satisfactory representation of the experimental data.

Equations have also been deduced for the dependence of the parameters on concentration, and these were used to predict the Newtonian viscosities measured by Maron and Belner below a volume fraction of 0.25. Good agreement was found between the observed and calculated viscosities. Further, on extrapolation to zero volume fraction the specific viscosity divided by the volume fraction corrected for adsorbed soap was 2.67 as against the expected Einstein 2.50 for suspensions of spheres, while extrapolation to infinite viscosity gave a volume fraction in very good accord with that expected for rhombohedral close packing of spheres.

Also, it has been shown that one Newtonian and two non-Newtonian flow units are sufficient for the description of the flow behavior of X-667 latex over a wide range of shear rates.

PART II

A concentric cylinder viscometer for the study of non-Newtonian flow at low shear rates has been developed. The bob of the instrument is part of the movement of a moving magnet galvanometer. An electromagnetic counter torque is used to null the viscous torque and the nulling current required is a measure of the viscous torque. This permits torque measurements over a wide range without non-linearity in the torque-current relation.

All points of friction have been eliminated and an accurate, wide speed range cup drive has been developed. The instrument is accurate, convenient to use, and allows rapid measurements. 38 pages. \$2.00. Mic 57-2375

RELAXATION PHENOMENA IN RADIOFREQUENCY SPECTROSCOPY

(Publication No. 20,891)

Edward Otto Stejskal, Ph.D.
University of Illinois, 1957

There is good evidence that many diverse varieties of motion are to be found in molecular crystals. Such crystals are composed of rather loose aggregations of entire

molecules and consequently the molecules possess a good deal of freedom. X-ray studies and dielectric constant measurements as well as heat capacity data give considerable indication that many such crystals possess several solid phases and that in each of these several solid phases there may be different kinds of motion and varying degrees of disorder present.

It was the purpose of this research to use nuclear magnetic resonance as a tool in the study of the motions within several molecular crystals. In particular, substances were chosen which contained methyl groups and no other protons. The methyl protons were the nuclear species to be studied. Studies already completed on the proton line shapes and line widths in these substances had given information regarding the probable kinds of molecular motion present. In an attempt to quantitatively study the rates of these motions, spin-lattice relaxation time measurements were performed on the protons in the molecular crystals of interest. Both temperature and frequency dependence studies of the spin-lattice relaxation time were made on these compounds. To interpret these data, a method was devised for relating the results of these measurements to conditions within the crystal.

The most studied motion was the hindered rotation of the methyl groups about their symmetry axes. If one assumes that the methyl group experiences a 3-nodal sinusoidal barrier to rotation about its symmetry axis, it is possible to solve exactly the Schroedinger equation which describes the motion of this methyl group. The resultant equation is called the Mathieu equation and involves continued fractions. The Illiac was employed in this task. This was done for a series of barrier heights. Several important features of the motion of the methyl group may be obtained from this treatment. Two different approaches were then employed to calculate spin-lattice relaxation times from this information. It was found that the approach based on the theory of Bloembergen et al. was quite capable of describing both the temperature and frequency dependence of this motion. It was thus possible to obtain estimates of the barriers to rotation experienced by the methyl groups.

In regions where self-diffusion or bulk molecular reorientation is more important than methyl group rotation, a less detailed analysis enabled the determination of activation energies and helped to correlate some of the other physical information available regarding the molecular crystals studied. 123 pages. \$2.00. Mic 57-2376

THE DETERMINATION OF THE POWER FACTOR OF A HIGH FREQUENCY ELECTRICAL DISCHARGE

(Publication No. 21,687)

Jerome R. Tichy, Ph.D.
University of Utah, 1957

Chairman: Dr. Ransom B. Parlin

1. The power factor of a high frequency electrical discharge in air for a range of 3.5 - 4.5 mc and 0-250 mm Hg pressure has been measured.

2. A chain mechanism has been proposed to account for the fixation of nitrogen in a high frequency discharge.

3. A biased random walk problem of an electron travelling through a gas in an AC field has been programmed and solved with an IBM 650 machine calculator.

4. An interpretation of the abnormal distribution of kinetic energies obtained in the random walk problem has been given in terms of non-uniform sampling of the collision population. 153 pages. \$2.05. Mic 57-2377

THE THERMAL ACCOMMODATION COEFFICIENT AND ADSORPTION ON TUNGSTEN

(Publication No. 21,106)

Yehuda Harold Wachman, Ph.D.
University of Missouri, 1957

Supervisor: Lloyd B. Thomas

J. K. Roberts has shown that the thermal accommodation coefficient (AC) of neon on a metal surface is markedly affected by the presence of adsorbed gases on the surface and that changes in the AC of the neon may be used to study adsorption.

In the present work we have prepared scrupulously clean tungsten filament surfaces, and exposed these to adsorbable gases and investigated the AC's of helium and neon on the resulting surfaces. Listed below are averages of limiting AC values of helium and neon (at 305°K) on adsorbate coated tungsten which we obtained by: (1) adding minute quantities of adsorbate to the experimental tube until the change in the AC became nil, (2) determining the AC of the inert gas in the presence of appreciable partial pressure of adsorbate gas, assuming that the two gases conduct heat in parallel and independently, and (3) removing all gas from the experimental tube by evacuation after the tungsten surface was coated with adsorbate, then admitting inert gas and determining the AC.

	Bare W	H ₂	D ₂	O ₂	N ₂
He AC	.0200	.0407	.0458	.185	.0396
Ne AC	.0550	.112	.117	.406	.117
	<u>CO₂</u>	<u>CH₄</u>	<u>C₂H₆</u>	<u>C₂H₄</u>	
He AC	.0404	.0343	.0258(?)	.0986	

Other apparently distinct adsorbed states gave AC values of helium .107, .084, and .065 on oxygen on tungsten; .0644 on nitrogen on tungsten; and .108 on carbon dioxide on tungsten. We also obtained values for the AC of hydrogen on oxygen on tungsten (.201 and .24) and the AC of CO₂ on CO₂ on W (.99).

Using the AC of helium as an indicator for adsorption, properties of some of the adsorbed layers were investigated. Adsorbed layers of hydrogen, deuterium and nitrogen corresponding to the helium AC values .0411, .046, and .064, respectively, were shown to be unstable at room temperature, giving a diminishing AC with time, when the partial pressures of the adsorbates are reduced to very low values by a getter of evaporated mischmetal.

The observations with oxygen showed that there are three, or possibly four, types of oxygen film on tungsten

thus generally substantiating observations by Morrison and Roberts.

The investigations with carbon dioxide, methane, ethane and ethylene were only exploratory. The observations with carbon dioxide suggest two types of adsorbed layer depending on the partial pressure of adsorbate in the system. Ethylene was observed to pass slowly through a liquid air trap, taking more than one hour to move 30 cm, yet to register time intervals of addition as intervals of breakthrough to the filament. The only plausible explanation we offer involves diffusion of ethylene on the glass surface of the trap.

We have tried an application of the AC technique to the direct observation of mobility of adsorbed hydrogen and nitrogen on tungsten. Within the capability of our method the hydrogen and nitrogen layers corresponding to the helium AC values .0411 and .0396, respectively, as immobile.

The AC values obtained for hydrogen (.164), deuterium (.236), and nitrogen (.642), on originally clean tungsten showed that the increasing AC from hydrogen to nitrogen tends to just compensate for the decreasing speeds of the molecules making the heat conduction of all three gases at equal pressures quite closely the same.

187 pages. \$2.45. Mic 57-2378

ECONOMICS

ECONOMICS, GENERAL

LAND TENURE AND RURAL ORGANIZATION IN TURKEY SINCE 1923

(Publication No. 21,406)

Evan Fotos, Ph.D.
The American University, 1957

As its legacy from the Ottoman Empire, the Turkish Republic received a very imbalanced land tenure system. The great majority of the Turkish peasants were either without any land or else did not own landholdings of sufficient size for practicing much more than subsistence agriculture. However, because Turkey was a country of fairly adequate arable land and low population density, the situation was far from desperate.

During the 1920's and 1930's the Government made various modest attempts, mainly through land distribution legislation, to improve the land pattern. Though advocated by certain members of the Turkish Government during this period, no comprehensive land reform was enacted into law until 1945. That Republican Turkey meanwhile had instituted a succession of reform measures of rather startling proportions in a multitude of spheres is well-known. Under the almost miraculous driving impetus of Kemal Ataturk, aided by a body of lieutenants, drawn mainly from the educated, westernized urban element, colossal reforms necessitating vast reorientations were undertaken. But serious land reform was deferred because it would have struck a crucial body-blow against a significant number among the parliamentary element supporting the Ataturk regime.

The long-discussed and long-anticipated land reform measure, ultimately overcame the opposition of this small but influential body of large absentee landholders among the Assembly members and reached the floor of the Grand National Assembly in early 1945. The reform law which resulted, besides possessing qualities which transcended the economic, envisaged far-reaching social and political changes. The law proposed to create a mass of independent peasant families in Turkey which could, in turn, create a free society, thus making possible a truly functioning and viable democracy. Private landholdings were to be limited to 1250 acres. One would have to work his land personally. If one did not cultivate his land for three successive years, he could have it taken from him. As for the widespread sharecropping institution, there were bold provisions for alleviating their plight.

Because of political considerations, dictated largely by powerful interests in the Assembly, the 1945 Law was only partially implemented. The successive governments saw to it that practically no privately-held land was expropriated, though it should be noted that a very appreciable amount of land--almost two and four-fifths million acres of state-held land--was distributed through 1955. Because insufficient tracts of land were generally made available to

the landless peasantry, though, these acquisitions permitted one to practice little more than subsistence farming. Also, whenever land was given in too small pieces, fragmentation of land, already a serious problem in Turkey, was accentuated still further. The Government did pay some, but not sufficient, attention to the problem of making credit available to the peasant. Along with the granting of land, the equally necessary credit instruments for establishing a viable peasant holding should have been further developed. Implementation of certain other provisions of the 1945 Law has resulted in the sharp reduction of absenteeism among landowners. Also, previously idle arable land has been brought into cultivation.

Since World War II, particularly since the Marshall aid program, the effect of rapid and widespread mechanization upon a portion of Turkish agriculture has made varying impacts upon the land tenure pattern of the entire country. Farm sizes have increased appreciably as has agricultural production. The sharecroppers, no longer necessary in farm operations, have been displaced in significant numbers. These people have flocked to the urban areas where they now pose a serious social and economic problem, which could well lead to a factor of political instability.

If democratic practices are permitted to take root in Turkey, the pattern of land tenure should assume a more healthy direction. As Turkey's peasantry, who constitute some 80% of the total population, become increasingly aware of the decisive influence they could bring to bear through the exercise of their franchise at election time, the rival political parties will be forced to go beyond the mere professing of noble land reform aims in their party platforms in order to gain and retain the favor of the awakening rural majority.

225 pages. \$2.95. Mic 57-2379

COMPETITIVE AND MARKETING ASPECTS OF THE MARYLAND CANTALOPE INDUSTRY

(Publication No. 21,527)

Marion Rosslyn Larsen, Ph.D.
University of Maryland, 1957

Supervisor: Dr. George Max Beal

Investigations undertaken in 1949 and 1950 at the request of cantaloupe producers were to ascertain (1) the competitive aspects of Maryland cantaloupe production, (2) the relative acceptability of Maryland cantaloupes by consumers and (3) the feasibility of developing quality improvement programs for cantaloupes. Maryland's cantaloupe industry had declined considerably due, admittedly, to low prices, inferior quality, increasing costs and competition, especially from vine-ripened cantaloupes from

the West. Many producers in Maryland have been lax in packing a high quality cantaloupe in an effort to exploit the early market.

Except for nearness to markets, Maryland producers were less favored as to yield, production, price, climate and quality of cantaloupes than western competitors. Western cantaloupes brought higher returns to distributors, wholesalers and retailers, and the consumer was willing to pay the higher price for the western melon which was superior in eating qualities to the general run of Maryland cantaloupes in 1949.

Taste preferences of 1,661 respondents divided into four groups representing various characteristics of the population in a typical market area revealed the following relationships based on preferences per 100 samples of cantaloupes tasted: (1) Maryland Hales of comparable sweetness were preferred 34 to 24 over western cantaloupes, while a one percent sweeter Maryland Hale was preferred by 42. (2) Maryland Hales were preferred 31 to 28 over East Coast Hales of comparable sweetness, and sweeter Maryland Hales were preferred by 46. (4) Maryland Pearl Pink Meats were preferred 35 to 23 over western cantaloupes of comparable sweetness, and one percent sweeter Pink Meats were preferred by 42. (4) Preferences for Maryland Hales, Pink Meats and Hackensack (major commercial varieties in Maryland in 1949) of equal sweetness were 34, 34, and 32, respectively. Samples of cantaloupes served were rated superior by respondents to the general run of cantaloupes purchased prior to the survey in 1949.

An analysis of purchasing habits of consumers showed that: three-fourths of the consumers preferred a medium size cantaloupe (36 and 27 commercial size); only 33 percent of households were eating all the cantaloupes they wanted, 45 percent did not purchase more cantaloupes because of poor quality, while only 22 percent declined further purchases because of price; households with higher incomes purchased more cantaloupes but not in the proportion of income differences; larger families purchased more cantaloupes, but per capita expenditures and consumption were less than in smaller families; non-white families purchased proportionately more cantaloupes at a lower price than white families according to income and size of family; consumers do not utilize reliable methods in selecting cantaloupes.

Preferences for Maryland Hales and western cantaloupes by a taste panel were very similar to those obtained in the 1949 preference survey utilizing similar cantaloupes. From laboratory tests coordinated with the taste panel, physical values of eating qualities (sweetness, juiciness, texture, depth of flesh, and color) were obtained. These values could be utilized to measure probable consumer acceptance at time of harvest and in packing shed operations to strengthen quality control programs.

Recent experimental foliar feeding of cantaloupe plants has increased the level of sweetness of cantaloupes and the yield. Experimental varieties of cantaloupes to meet climatic conditions in Maryland are now in developmental stages. These developments give promise of a possible future expansion of Maryland's cantaloupe industry. Findings in this study point to the need for a well-organized quality control program to insure a pack of uniformly high quality. Under prevailing conditions of small acreages, a cooperative endeavor would provide the best approach to adequate harvesting, sorting, grading and packing facilities

and a stronger bargaining position in the market place. 416 pages. \$5.30. Mic 57-2380

DISEQUILIBRIUM IN THE SOUTH AFRICAN BALANCE OF PAYMENTS BETWEEN 1925 AND 1952

(Publication No. 19,117)

Georg Marais, Ph.D.
The University of Wisconsin, 1956

Supervisor: Professor Paul T. Ellsworth

South Africa was faced with an unfavorable balance of payments after the Second World War. At first glance, one would be inclined to attribute this disequilibrium to general post-war conditions.

However, a more careful analysis leads one to attribute this unfavorable balance of payments mainly to an internal structural disequilibrium rather than to a cyclical disequilibrium alone. This analysis attempts to distinguish between the effects of cyclical and of structural disequilibrium in the internal economy on the balance of payments. It shows that the policies followed by the governmental authorities have been concerned mostly with cyclical disequilibrium and that their efforts have had the effect of magnifying the basic structural disequilibrium.

In 1925, South Africa initiated a policy of protection of manufactures. The structural disequilibrium growing out of the development of manufacturing industries is the primary cause of the disequilibrium in the balance of payments. The growth of the population and the relatively high wages paid in manufacturing caused a sharp rise in national income. This increase in income led to a rise in the demand for local and imported consumption goods. The larger demand for locally-produced commodities, in turn, stimulated increased imports of capital equipment and raw materials for manufacturing.

However, the growth of exports, especially of manufactured goods, lagged far behind the rapid growth of total imports and produced a balance of payments deficit. This situation was brought about by the peculiar structure of the South African labor market and by tariff protection given to inefficient raw material-producing industries. The growth of exports was also retarded by the high cost of labor. Competition for labor between inefficient protected industries and more efficient industries (notably the gold mines) forced wages up.

Analysis of the cyclical movements in the balance of payments reveals that the volume of imports reacted more strongly to changes in income than did the volume of exports. Moreover, the analysis reveals that changes in export prices determined changes in the terms of trade because export prices showed greater fluctuations than import prices. Traditionally, during a depression, when the value of exports (gold excluded) falls relatively more than the value of imports, gold (price remaining constant) can fill the gap. During prosperity, when the purchasing power of gold declines, the value of other exports has to increase to maintain equilibrium. This was not the case in the post-war period.

It is possible for structural and cyclical disequilibrium in the balance of payments to be corrected by monetary and

fiscal policies and by exchange adjustment, without correcting the misallocation of domestic resources. However, in South Africa, such a correction would be only temporary. The long-term policy of the Government is to stimulate artificially the development of manufacturing and to maintain high agricultural prices which will again cause disequilibrium.

The study shows that the fiscal and monetary authorities failed to take effective measures to restore a temporary equilibrium in the balance of payments. In the short run, the restoration of equilibrium was left to such external measures as exchange depreciation and import control.

During the last thirty years, there were two instances of exchange depreciation. In 1932, exchange depreciation stimulated the growing structural disequilibrium and made the country more dependent on gold exports. In 1949, devaluation caused an improvement in the balance of payments, but this effect was soon cancelled by inflationary conditions both at home and abroad. The Government came to depend upon import control to maintain a precarious stability in the balance of payments.

The conclusion of this study is that the Union of South Africa cannot achieve a sound economy until the internal structural disequilibrium is corrected.

324 pages. \$4.15. Mic 57-2381

THE CONSUMPTION DECISION AND IMPLICATIONS FOR CONSUMER EDUCATION PROGRAMS

(Publication No. 21,300)

Mary Beth Minden, Ph.D.
Purdue University, 1957

Major Professor: Richard L. Kohls

The Agricultural Extension Services have placed increased emphasis on work with consumers of agricultural products during recent years. The basic objectives of these programs are to improve food buying practices and to assist consumers in making choices at the market place. It is assumed that changes made will lead to greater satisfaction for consumers. A requisite to carrying out such programs is an understanding of existing consumer behavior. Within this setting the following objectives were outlined for this study:

1. To determine consumer knowledge and behavior patterns and to analyze these for implications for consumer education programs.

2. To determine food buying interests and problems of Indiana urban consumers and to derive their relative responsiveness to certain types and sources of information currently included in consumer education programs in food and food marketing; to analyze these in terms of motivational implications for an Indiana consumer education program.

Methodology was as follows: A theoretical framework of the consumption decision was constructed as a basis for the study. Data of both a primary and secondary source were used, with the secondary data being assembled by means of a reading survey of approximately two hundred consumer and marketing studies published since 1945 and the primary data being collected through a field survey of

sample households in three Indiana cities. The secondary data were treated in a manner to determine the relative importance of price, quality, and convenience as reasons for choices made under various food buying decisions. The field survey was designed to supplement the secondary data and was planned to give direction to Indiana consumer education programs in terms of determining motivating interests of urban consumers. Field survey data were treated in a manner to determine inherent responsiveness of consumers to selected phases of consumer education programs.

Three reasons for food purchase decisions were analyzed: price, quality, and convenience. Under most situations quality was of first importance, price was of second importance, and convenience was third. There were differences in this order, however, when specific buying situations were analyzed. Price tended to be of greater importance to the middle income group, while quality was of least importance to those with high school education.

Most of the food buying interests and problems reported by Indiana homemakers might be summarized as those dealing with adding variety to menus and those concerned with meeting the food preferences of individual family members. One-fourth of the homemakers said they had no food problem.

The inherent responsiveness of urban consumers to five subject matter topics was studied. These topics included information regarding economizing, time management, food selection, the food market, and nutrition. With the exception of nutrition, all topics were of similar and strong appeal. Consumers were slightly more responsive to time management information and somewhat less responsive to food market information and buying helps. There were some differences among various socio-economic groups, but generally speaking, the differences were few. This indicated that for such a program as is being conducted through the use of mass media, these topics would be of general interest to most of the urban consumer population. Nutrition was of least interest as a topic of information.

Three attributes of the individual were also studied to determine their usefulness as motivational considerations in food programs. These included the social, creative, and prestige natures of the homemaker as a consumer. Strong response to these attributes was indicated for 70 percent of the homemakers studied, with most of the remaining homemakers indicating high response to at least one of these attributes. Thus, the food responsibilities of homemakers as an outlet for these attributes would be of strong interest and are good motivational considerations for consumer programs. These considerations appeared to have greater appeal to the higher income groups, to those with more education, and to the professional, managerial, clerical, and sales worker occupation groups.

A summary of consumer shopping and food management behavior was made from both the secondary sources and the survey data. Included were details on shopping behavior, the family food budget, methods used in economizing, and food planning practices.

Study was also made of the frequency of use of various sources of food information. Written sources appeared to be more frequently used by those with more education. Those over 65 reported that they seldom used food information from several of the sources.

328 pages. \$4.20. Mic 57-2382

MONOPOLY AND COMPETITION IN NATURAL GAS PRODUCTION: A STUDY OF NATURAL GAS FIELD MARKETS
 (Publication No. 21,646)

Edward J. Neuner, Jr., Ph.D.
 Columbia University, 1957

One of the main issues in the controversy over federal regulation of natural gas production is whether or not a monopoly condition exists which necessitates public price-fixing of a character generally associated with utility regulation. Despite widespread interest and numerous legislative hearings, it cannot be said that the nature and the degree of this asserted monopoly condition have been fully developed in a public record. The objective of this study, therefore, has been to investigate relevant aspects of monopoly and competition in natural gas production, with the aim of providing a more complete factual and analytic foundation upon which to base a rational policy decision.

Toward this end, an analysis of natural gas field market transactions extending over a period from 1945 to 1953 was undertaken, the source data for which were approximately 700 natural gas purchase contracts negotiated between interstate pipelines and independent gas producers. These data, classified into nine gas supply areas, were processed to obtain price, volume, and other information. One immediate and important result was a more complete picture than has hitherto been obtainable of the changing pattern of natural gas field prices between 1945-1953. A second result was the provision of a factual basis for the analysis of field market behavior and market practices.

In addition to the above, other sources of data were investigated in order to ascertain the conditions of structural monopoly and to measure concentration levels in natural gas production. Considerable attention was also given to an analytic presentation of the sources of market power available to gas producers, as well as the monopolistic potential of various field market practices. These factual and analytic results were then utilized as support for a detailed evaluation of monopoly in natural gas production.

In general, on the basis of these data, the conclusion reached is that the degree of structural monopoly and the evidence of monopolistic behavior are not sufficient, by themselves, to justify administrative price regulation. Thus, the existence of collusive seller monopoly could not be supported by any direct evidence of seller agreement; nor could it be substantiated inferentially by reference to pricing or other forms of market behavior. On the other hand, structural conditions relating to the number and distribution of firms appeared capable of sustaining a workable competition in natural gas field markets.

However, there is the possibility that, as a consequence of the widespread use of various marketing devices not necessarily monopolistic in their origins, this competitive potential might not have been fully realized. It is, in fact, highly probable that the current price structure in the gas field is being distorted above competitive levels by the combined effect of certain field market practices. These practices, namely long-term purchase contracts, favored-nation clauses and price redetermination provisions, taken individually, appear to be fully consistent with competitive seller behavior; in combination, though, and accentuated by the fact of a considerable buyer immobility, they may

lead to field prices substantially above long-term competitive norms. Such a distortion may be the real basis for objections to recent price results of an unregulated field market for gas. The process by which this combination of practices can lead to the asserted distortion is, of course, fully treated in the study. Moreover, the question whether an amelioration of the condition requires full-scale administrative price-fixing is also examined, and the possibility of a solution short of price regulation is given careful consideration.

526 pages. \$6.70. Mic 57-2383

AN HISTORICAL STUDY OF THE COLLAPSE OF BANKING IN DETROIT, 1929-1933

(Publication No. 21,072)
 Howard Ralph Neville, Ph.D.
 Michigan State University, 1956

On March 6, 1933, the newly inaugurated President of the United States, Franklin Delano Roosevelt, proclaimed a banking holiday for the United States. During the previous twenty days authorities in almost every state had either proclaimed banking holidays or had made provision for the restriction of payment for deposits. The first state to reach a crisis and to have a banking holiday proclamation was Michigan on February 14, 1933. Some banking authorities put much of the blame of the Michigan crisis and, therefore, of the national holiday on two large group banking systems operating at the time in Detroit.

The purposes of this study are to try to determine whether the Michigan banking holiday was a catalyst instrumental in making President Roosevelt's proclamation inevitable and to determine whether or not the group banking systems should receive the main force of criticism they have received.

The procedure followed was to examine the literature in the general field of banking but also in the narrower field of multiple banking. Further, the testimony of banking people taken before the Senate Committee on Banking and Currency and that taken before a Detroit one-man grand jury inquiring into the Michigan banking holiday were studied.

The second proposal would introduce a permanent committee, appointed by the Secretary of the Treasury, which should constantly review the banking structure and which should make recommendations to the Senate and House Committees on Banking and Currency.

179 pages. \$2.35. Mic 57-2384

SOME MEASUREMENTS OF CONSUMER DEMAND FOR MEATS

(Publication No. 21,073)
 Harold M. Riley, Ph.D.
 Michigan State University, 1954

This study was an attempt to measure consumer responses to changes in prices for different kinds of meat.

Previous demand studies of this nature have been based almost entirely upon annual average prices and quantities for broad groups of meats for the entire United States. In most cases the period for these studies has been the interval between World Wars I and II. It was believed that demand relationships based on more recent observations and for periods of time shorter than one year would be a useful supplement to these earlier studies.

The basic data for this study were the weekly food purchase records of the M.S.C. Consumer Panel. This panel is composed of approximately 250 families selected so as to be representative of the city of Lansing, Michigan. Weekly average prices and quantities purchased per family were available for a two year period, July 1951-June 1953. Fortunately this was a period of substantial price changes for both beef and pork.

Single equation demand models were fitted to the data using least squares regression techniques. The basic equations expressed the quantity purchased of one kind of meat as a function of the price of that meat group, the prices of competing meats, and a temperature variable.

It was found that the price elasticity of demand for both beef and pork were near unity at their respective mean values. Beef prices seemed to have a significant influence on pork purchases; however, pork prices had a somewhat weaker influence on beef purchases for the period studied.

The prices of sausage, poultry or fish did not have a significant influence on either beef or pork purchases. The price elasticity of demand for sausage meats was not significantly different from zero while poultry and fish appeared to have elastic demands. The price elasticity of demand for all meat was about -.7 at the mean value of price and quantity.

Temperature was significantly related to meat consumption during the warm season of the year. An increase of 10 degrees in the weekly average of mean daily temperatures depressed purchases of pork, beef, and all meat by approximately 8 percent.

A preliminary analysis of demand for retail cuts of meats indicated that the price elasticity of demand for beef steak was highly elastic. The price elasticity of demand for beef roasts, ham and pork chops was slightly elastic while the demand for ground beef and bacon was slightly inelastic. 247 pages. \$3.20. Mic 57-2385

ECONOMICS, COMMERCE - BUSINESS

THE COOPERATIVE MARKETING OF ALMONDS—A CRITICAL ANALYSIS OF THE MARKETING POLICIES OF THE CALIFORNIA ALMOND GROWERS EXCHANGE

(Publication No. 21,567)

John Robert Cox, Ph.D.
Stanford University, 1957

The California Almond Growers Exchange represents some 4500 member almond growers and annually markets approximately 70 percent of the total domestic almond crop. This study undertakes a critical analysis of the marketing policies of this large, centralized cooperative

as they relate to market structure, channels of distribution, pricing, sales, and advertising. Policies are examined, first, for internal consistency with both the primary and secondary objectives of this cooperative and, secondly, for external consistency with current marketing policies and practices of other successful organizations engaged in the marketing of comparable food products.

In view of the nature of the problem, this study first undertakes the development of essential background for the analysis of complex and interrelated marketing policies by tracing the pattern of growth of the Exchange from its inception in 1910 to its present role of leadership vis a vis the almond industry. In addition, investigation reveals fundamental marketing problems created by increasing domestic almond production, limited apparent domestic consumption, and the continuous threat of substantial importations of low-cost foreign almonds from Spain and Italy. Wide fluctuations in the size of the annual domestic almond crop, resulting from the vagaries of nature, coupled with a considerable inelasticity of demand, further contribute to the complexities of marketing this farm commodity. Although almonds are highly nutritive, they are a non-essential food and in terms of their normal price to the consumer generally represent a luxury food item in the average American diet. Increasing net plantings of almonds by Exchange members, resulting from food financial returns in recent years, together with extensive fertilization, irrigation, and other improved horticultural practices appear to give promise of even larger domestic crops in the face of limited domestic consumption.

The Exchange takes the lead in the industry in seeking to encourage favorable legislation to assist in the solution of these long-term marketing problems. This study reviews the development of current tariff protection from foreign almond imports and evaluates the federal marketing agreement for almonds, which went into effect in 1950, as it seeks the dual objective of stabilizing the almond market by attempting to more nearly equate domestic supply and demand through establishment of saleable and surplus percentages of merchantable almonds and of providing further protection from imports by means of presidential establishment of import quotas and import quota fees whenever the effects of the marketing agreement would be endangered by such imports.

The market for almonds is predominately a shelled-nut market consisting of large industrial consumers. Accordingly, the Exchange operates in Sacramento, California a large plant devoted exclusively to the storage, grading, shelling, processing, and packaging of almonds to meet the varietal, size, and quality specifications for the natural and processed almond requirements of manufacturing confectioners, bakers, ice cream manufacturers, and nut salters. This study demonstrates the significance of this integrated operation in the performance of marketing functions and the development of marketing policies.

In the determination of Exchange marketing policies, the writer investigated every possible source of explicit policy statements in Exchange publications, in formal policy manuals, in correspondence and reports, and in repeated interviews and meetings with Exchange management. In a limited number of cases where formal policy statements were not evident, implicit policies were inferred by the writer from executive actions, informal statements of management, and interviews with almond

industry representatives outside the Exchange. This exploratory research reveals Exchange marketing policies to be generally consistent with the primary and secondary goals of this farmer cooperative; but certain alternative policies are suggested by external comparison with the policies and practices of other successful firms engaged in the marketing of food commodities.

210 pages. \$2.75. Mic 57-2386

**SOME ACCOUNTING PROBLEMS
CONCERNING REALTY HELD IN TRUST**

(Publication No. 21,436)

Clayton Roald Grimstad, Ph.D.
The Ohio State University, 1956

Accounting for realty held in trust involves careful distinction between income and principal from the time of acquisition of the property, throughout its productive life, until disposition, or termination of the trust. The problem is complicated by the fact that the creator's wishes, as interpreted by the courts if necessary, will control the trustee's accounting. Trust law, whether statutory or derived from court decisions, also will affect the trustee's accounting. Generally accepted accounting procedures can be applied only when not in conflict with these factors.

No single carrying value is used in the trustee's accounts for realty held in trust. Inconsistent procedures are commonly used in apportioning revenues and costs. Depreciation generally is not considered as a cost in determining income payable to the life beneficiary. Present tax laws relating to depreciation favor the income beneficiary to the detriment of the remainderman.

The legal literature and cases pertinent to this area of trust operations have been examined in the study. Many active trust accounts were also examined. Attorneys experienced in the field and trust officers of several banks were interviewed to determine what recommendations were made to clients with respect to alternative accounting procedures, what accounting practices were followed in trusts under their administration, and what factors influenced their decisions to follow the procedures used, as well as to ascertain the prevailing attitudes toward possible changes.

The results of the study indicate that the carrying value used for realty has little significance except as a tax basis. The probate appraisal, or the estate tax appraisal, is a satisfactory carrying value for use in testamentary trusts. The donor's adjusted tax basis could well be used in the trust accounts, thus eliminating a common discrepancy between the ledger accounts and the tax records.

Apportionment of receipts and disbursements between income and principal should be done consistently. Rents and taxes in particular must be carefully considered at the inception and termination of a trust to assure an equitable measurement of interests accruing to all parties. Statutory changes will be necessary to achieve apportionment in many states.

Where assets come into trust under a will or are purchased by the trustee under a mandatory provision to invest in realty, a charge for depreciation is usually undesirable. The testator typically wishes to provide maximum

benefits for the life beneficiary, but attorneys and trust officers should exercise great care to fully inform the testator of the consequences, particularly in regard to taxes, of failing to provide for depreciation. Assets acquired by the trustee subsequently to the creation of the trust should be subject to depreciation. Failure to charge depreciation against income will result in a gradual wasting of the trust corpus.

Statutory changes making depreciation mandatory would be dangerous and undesirable. Permissive legislation, under which the trustee could exercise discretion, would be beneficial. Perhaps the greatest advantage of such legislation would be to create an awareness of the problem.

Trust officers, attorneys, and accountants engaged in estate planning must be alert to the importance of using accounting as a control. By careful planning and drafting of accounting provisions, the testator or donor can be assured of the execution of his wishes.

121 pages. \$2.00. Mic 57-2387

**CYCLICAL FLUCTUATIONS AND THE
MANAGEMENT OF RETAIL INVENTORIES**

(Publication No. 20,579)

Richard M. Hill, Ph.D.
Columbia University, 1957

This is a study of cyclical fluctuations in retail inventories and the manner in which managerial practices may have contributed to the behavior of these movements. Since inventory accumulations and liquidations are the result of buying decisions, it appears self-evident that the principles and practices which enter into such decisions have an important bearing on these movements. The task of unraveling the role of management in the behavior of an economic series is undertaken in two major parts. The purpose in the first part is to discover the pattern and significance of cyclical movements in the book value of retail stocks. To this end, cycles in various categories of retail stocks are analyzed and an effort is made to appraise the relationship between these cycles and those in general business. The second part is devoted to an examination of the principles of retail inventory management and the manner in which these principles are applied in an important segment of the retail trade.

Statistical measurements indicate that with the exception of food stores, inventories in all major categories of retail business reveal evident cyclical movements. The timing, duration, and general pattern of these cycles of course vary with different types of stores. For the most part, cycles in the stocks of durable goods stores are shorter in duration, greater in amplitude, and display a more pronounced pattern than do stocks of nondurable goods stores. In the case of both durable and nondurable goods stores, however, the expansion phase of inventory cycles is typically longer in duration and greater in amplitude than the contraction phase.

A comparison of the timing and duration of retail inventory movements with the business cycle reference dates selected by the National Bureau of Economic Research indicates a positive conformity between the inventory cycles and business cycles. While there is some

tendency for turns in the inventory series to lag turns in general business, on the whole, periods of accumulation and liquidation in retail stocks coincide with the booms and recessions in general business. It would appear, therefore, that retail inventory movements constitute an aggravating factor in the business cycle.

The fundamental objective of retail inventory management appears to be the maintenance of a balanced stock. This condition of inventory balance is apparently the major consideration in buying decisions. It may be defined as the closest possible correspondence between merchandise in stock and the customer demand that is consistent with store policy. At any given time, the amount of merchandise which must be in stock to assure a balanced condition is governed by the anticipated rate of sale, the time lag between the reorder of merchandise and its receipt into stock, the length of the period between stock counts, the size of the basic stock, and the amount of the safety factor desired.

While statistical comparisons reveal that in general retail stocks tend to rise and fall in response to increases and decreases in retail sales, there is too much "independence" of movement in the two types of series to account for their relationship solely on the basis of balanced stocks. The task of explaining inventory movements in terms of managerial techniques resolves itself therefore into a problem of explaining why retail stocks are so frequently out of balance. On the basis of a survey of merchandising executives with regard to prevailing techniques of inventory management, a number of factors were identified which appear to have a good presumptive claim of being responsible for some of the deviations in the behavior of retail sales and stocks. Foremost among them are the heavy reliance upon past sales experience in making sales forecasts, the reluctance to accept widespread markdowns, the psychology of "beating last year's figures", the types of control systems employed, and the practice of "protective" buying during periods of uncertain supply conditions.

429 pages. \$5.50. Mic 57-2388

The study is introduced by a descriptive summary of noneconomic features of the people and the country. As a method of estimating the capacity of the economy, the balance of payments is examined. Because of the accumulation of foreign exchange brought about by increased oil royalties, a national development program was initiated under the direction of the Development Board. Since the relatively huge expenditures contemplated by this Board may produce inflationary pressures, an analysis of monetary, foreign exchange, and fiscal policies is made; and the effectiveness of existing monetary and fiscal machinery is evaluated. Finally, the development program and the obstacles confronting economic expansion are surveyed.

It was found that since 1951 the value of imports has increased substantially and the composition of imports has shifted noticeably toward capital goods. This import trend and the limitation of non-petroleum exports were deliberately fostered as an effective measure for preserving reasonable price stability. In order to continue such a constructive trade policy, however, it is imperative that careful attention be given to the maintenance of adequate reserves of foreign exchange.

On the domestic side of the economy, both monetary and fiscal controls as presently constituted are inadequate to assure orderly economic expansion. The main weaknesses include the highly liquid condition of the commercial banks, the absence of organized money and capital markets, and the inflexibility and limited scope of government expenditures and revenues. To deal effectively with these conditions, the National Bank should be authorized to set reserve requirements within broader limits, to exert direct control over the lending policies of the commercial banks, and to organize money and capital markets. The Treasury should be empowered to vary tax rates and to introduce new taxes, particularly on the largely untaxed income from agriculture which constitutes a major portion of national income. Also, an improvement in administrative techniques and greater coördination of monetary and fiscal policies will be necessary for orderly economic expansion.

Essential natural resources required for economic development exist in relative abundance. However, the prevailing standard of living and the social structure of Iraq constitute the most serious obstacles. In order to achieve its goal, the development program must, therefore, include public health measures and the provision of general and technical education and the like, in addition to major public works and the improvement and expansion of agriculture, industry, and transportation.

243 pages. \$3.15. Mic 57-2389

ECONOMICS, FINANCE

IRAQ'S BALANCE OF PAYMENTS AND ECONOMIC DEVELOPMENT, 1947-1955

(Publication No. 21,470)

Evans Elias Ghazala, Ph.D.
The Ohio State University, 1957

In 1951-1952 the negotiation of new oil agreements with the oil companies operating in Iraq substantially increased royalties paid to the Iraqi government. As a result, the country's balance of payments has changed from one of persistent deficits to one of unprecedented surpluses. Iraq is now confronted with the problem of utilizing these surpluses in an intelligent program of internal economic development. The study is concerned with an appraisal of the country's economic potential and the ability of the present administration to carry out such a program without producing disruptive price inflation.

ECONOMICS, HISTORY

BRITISH TRADE UNIONISM AND NATIONALIZATION:
1868-1945. THE EVOLUTION OF THE
NATIONALIZATION POLICIES OF THE
BRITISH TRADES UNION CONGRESS.

(Publication No. 21,623)

Herbert E. Weiner, Ph.D.
Columbia University, 1957

Theories of social action were significant, but marginal, in determining the policies of the British trade union movement with respect to the public ownership or control of industry. While colored by strong feelings of long range social idealism, the demands of the British trade union movement for the nationalization of selected industries and services were shaped in the final analysis in non-doctrinaire fashion by the institutional and economic interests of the trade union movement in the light of the opportunities and necessities of the contemporary environment.

The approach of British trade unionism as expressed in the policies of the British Trades Union Congress (TUC) from its founding in 1868, was evolutionary. The TUC, after initially resisting ideas of social ownership, accepted nationalization in the 1880's in the Liberal-Radical tradition for the conversion of private monopoly to the public domain to maximize individual economic opportunity. It was not until the end of World War I that nationalization completed the transition in TUC policy to a socialistic concept for the communal ownership of property; and it was not until the 1930's that the individual proposals by the trade union movement for nationalization fell into a general pattern for economic planning. Policies auxiliary to nationalization such as "workers' control", methods of administering nationalized industries, and basis of compensation to former owners, labor-management relations, and the whole purpose of nationalization as an instrument of economic policy also evolved sympathetically as to content and form.

The nationalization policies of British labor as they emerged in 1945 were conditioned essentially by the inter-war depression. In specific situations they evolved in response to persistent national problems which seemed insoluble by other than radical governmental action. In a broader sense policies of nationalization were encouraged by powerful political and economic trends which favored the centralization of authority and greater state intervention in the economy, and by a strengthening belief in the nation that bold fundamental measures were necessary to correct deficiencies in Britain's economic structure. For its part organized labor, having rejected doctrines of revolutionary extremism, compromised to win political support for its program outside the labor movement. British labor also drew upon the experience with some of the problems of public ownership and control as in broadcasting, electricity distribution, transport and coal, under non-labor governments; and it became a party to the large measure of general non-partisan agreement which developed in Britain as to the structure and principles which should characterize the operation of a publicly-owned enterprise e.g. the public corporation.

By the end of World War II, it can be said that while nationalization was identified with organized labor in partisan politics, the heated political controversy over it did not

represent an irreconcilable ideological cleavage in the nation. British organized labor, while carrying the standard of large scale nationalization in some spheres as essential to its program of economic planning otherwise justified the continuance of private enterprise. The Conservatives and Liberals, for their part, clearly were prepared, also in non-doctrinaire fashion, to accept in varying measure a considerable extension of public ownership and control in the economy on a permanent basis.

This study analyzes through the annual reports of the British Trades Union Congress the entry of nationalization into TUC policy. It describes the institutional pressures that subsequently moulded labor's nationalization policies, and the evolution of specific demands such as those dealing with land, railways, electricity, banking, insurance, transport, and coal, until in 1945 the first Labour Government was elected with a popular mandate to nationalize certain basic goods and services as a measure of national reconstruction.

572 pages. \$7.25. Mic 57-2390

ECONOMICS, THEORY

ON THE EXPLANATION CONCEPT IN ECONOMICS

(Publication No. 21,629)

James F. Becker, Ph.D.
Columbia University, 1957

This is a "case study" of the influence of the economist's scientific principles and objectives upon his economics, the latter including his theoretical constructions, of course, but also his research more generally. Apart from a brief survey of the scientific goal and related principles of certain classicists preceding Mill and Jevons, the thought and work of these last two men comprises the material under examination. In the classical economics (including Mill and Jevons) "explanation" is the primary end. The norms to which the individual adheres as investigator are associated with his conception of that goal. The philosophic analysis in which he indulges enlarges his comprehension of ways and means to its achievement. This, in turn, affects his orientation as a researcher; it also influences his evaluations of his own, as well as others', contributions to economics.

Thus, while logical consistency is a norm to which both Mill and Jevons subscribe, their analyses of the character of formal logic, differing at a number of critical points, lead them to prefer quite different notational forms (literary vs. symbolic) for the presentation of their theories. Again, Mill's philosophic emphasis upon the formal pattern of explanation (Composition of Forces), derived in part from his view of mechanical explanation as an "ideal type," causes him to veer in the direction of economic dynamics in his Principles. Jevons, on the other hand, considers an empirical aspect of scientific explanation, the "identity" or "resemblance" which it suggests, as its most significant characteristic, consequently, his theory is distinguished by employment of a construct (utility) which facilitates his achieving this effect.

Not only their theories, but their whole conceptions of

the field of economic research are related to an understanding of scientific principle. This is particularly evident with Jevons whose theory of knowledge, founded upon probabilities, emphasizes the validity of those varied lines of research in which he engaged as an economist. His statistical pursuits are in marked contrast to Mill's activities as investigator. The scope of his endeavors is relatively limited, consisting largely of a literary theorizing in conformity with his theory of logic and that explanatory ideal summarized in the phrase *Composition of Forces*.

Finally, one's estimates of the explanatory value of theories are related to abstract principles of science. The basis for Mill's scepticism of mathematical economics is seen to lie in his theory of logic. Jevons' valuations of empirical research and institutional economics are tied to

his theory of probabilities. Other instances of direct relationship between scientific principle and the economist's "product," i.e., his economics, are suggested and analyzed.

As an end of economic research, "explanation" is today as serviceable as ever it was, though whether our institutions of research contribute to its achievement with optimum efficiency is an open question. Progress in development of institutions of economic research is still related to developments in logic and philosophy of science. There are indications that the services of the theorist are currently under-valued; that his peculiar insights, particularly for policy prescriptions, are not being adequately utilized. Failures of economists to perceive and grapple with this circumstance may be related to a lack of sympathy with or understanding of the aim of classical science.

344 pages. \$4.40. Mic 57-2391

EDUCATION

EDUCATION, GENERAL

A PROPOSAL FOR STRENGTHENING THE PROGRAM OF AGRICULTURAL EDUCATION IN THE AGRICULTURAL, MECHANICAL AND NORMAL COLLEGE OF ARKANSAS

(Publication No. 21,052)

Richmond Cowan Davis, Ph.D.
Michigan State University, 1956

Purposes. To evaluate the program of agricultural education at the Agricultural, Mechanical and Normal College and to offer suggestions for its improvement.

Method. A questionnaire comprising the competencies required of teachers of vocational agriculture and county agents was developed. Revised in accordance with suggestions from an advisory group one questionnaire containing 202 items was ultimately designed for teachers of agriculture and one containing 146 items was designed for extension workers.

Using a rating scale, fifty-six teachers of agriculture and sixteen extension workers were asked to rate the degree of preparation received in their pre-service agricultural education program at the Agricultural, Mechanical and Normal College. Analyses were made of the curricular offerings in agricultural education at the College from 1929 to 1955 and of the present program in ten selected institutions. A comparison was made between the curricular content in these institutions and in the present program in agricultural education at the College.

Findings and Interpretations. Both teachers of agriculture and extension workers rated their degree of preparation in professional agriculture higher than that in technical agriculture. At the same time teachers of agriculture tended to rate their degree of preparation in professional education higher than did extension workers.

In determining the level of the degree of preparation, the areas of "youth leadership organizations", and "farm forestry" were classified as few. Many of the areas while

falling within the median group had competencies rated as low. The year of graduation had no appreciable effect upon the distribution of the ratings of the respondents in professional education but did influence technical agriculture.

The present program of agricultural education at the Agricultural, Mechanical and Normal College was found to be very close to the median of the ten selected institutions in the number of hours required for pre-service training. In certain areas, the number of hours required did not seem to be closely related to the degree of preparation.

The following recommendations were suggested for improving the program of agricultural education:

1. The staff in the Division of Agriculture should consider more professional courses for extension workers.
2. Course offerings of the agricultural education program, in areas classified as low and in areas which contained abilities classified as low should be subjected to careful investigation by the Division of Agriculture.
3. A basic group of competencies for teachers of vocational agriculture and county agents should be developed by a committee composed of staff members of the Division of Agriculture and a representative group from vocational agriculture and extension work.
4. A committee on research be formulated, if one does not already exist, composed of staff members from both professional and technical areas.
5. A program of inservice training in agricultural education be developed.
6. An evaluation should be made of the use of existing facilities and equipment to determine possibilities of improving the training program.
7. Course offerings should be combined into fewer departments to facilitate the introduction of changes, the elimination of duplication and provide for better balance in the instructional program.

192 pages. \$2.50. Mic 57-2392

**EVOLUTION OF CONCEPTS OF INDOCTRINATION
IN AMERICAN EDUCATION**

(Publication No. 21,569)

Richard Hugo Gatchel, Ph.D.
Stanford University, 1957

Until near the end of the First World War the term indoctrination seldom appeared in its present derogatory sense. Few American educators questioned the justification for the existence of indoctrination as instruction in principles or doctrines. Since that time, however, the interaction of social and educational forces has led to the point of view that indoctrination has undemocratic connotations.

This dissertation explores the nature of that interaction and traces the development of the major concepts of indoctrination from the turn of the century to the present. It analyzes the change from indoctrination as "instruction" or "teaching" to its present connotations, especially to such derogatory connotations as "soul-destroying pedagogy" and "the uncritical implantation of beliefs." Finally, it explores the plausibility of the term enculturation as a broader term subsuming indoctrination.

An etymological analysis assesses the various terms involved in the study including education, imposition, inculcation, indoctrination, enculturation, and democracy. It indicates the Greek and Latin roots of "indoctrination" and its early identification with medieval European education as primarily a process of "bringing up" rather than of "leading forth." It traces the continuation of that concept of education into modern times when, faced with evolving concepts of democracy, it could no longer stand unquestioned.

The first historical period of this study, 1894-1919, explores the developments in education, philosophy, psychology, and sociology and also the socio-political changes which underlay the ensuing controversy over indoctrination. Here appear the various roots, historical and contemporary, which made indoctrination a controversial issue during this period. In the ensuing period, 1919-1932, indoctrination faced more definitive concepts of social democracy and became a focal problem for many American educators. The writings of Dewey, Kilpatrick, Bode, Childs, and other Progressive educators together with the American reaction against German authoritarianism made this period one of increasing objection to indoctrination.

The publication in 1932 of George S. Counts' Dare the School Build a New Social Order? brought the conflict to a head. The ensuing debates centered about (1) the diverse value judgments concerning indoctrination even as biased instruction and (2) the effort by some educators to check the tendency toward an exclusively derogatory definition of indoctrination. The debate ended in the widespread derogation of the term indoctrination.

The final chapter of the study relates indoctrination to concepts of socio-political control in American democracy. The present writer describes how current discussions of indoctrination fall short of the central issue and concludes that the discussion must focus on its place in a pluralistic society. An analysis of Professor W. H. Cowley's point of view that limited pluralism constitutes the core of American democratic socio-political control shows the inevitability of indoctrination in a free society. Finally, the study of Melville J. Herskovits' and Professor Cowley's use of

"enculturation" presents this term as descriptive of cultural transmission, indoctrination being a kind of enculturation.

259 pages. \$3.35. Mic 57-2393

SPIRITUAL EMPIRICISM AND THE LIBERAL ARTS

(Publication No. 21,435)

John Hawkes Green, Ph.D.
The Ohio State University, 1956

An important concern in higher education today is the neglect of the spiritual. This concern is reflected in conferences and varied efforts of colleges and universities to bring spiritual values to the campus. These efforts are mostly extra-curricular, whereas the heart of the matter lies in the educative process itself--which may properly be defined as the nurture of the human spirit.

The dissertation examines the psychical theories of consciousness developed by William James, Henri Bergson, John Dewey, Henry Nelson Wieman, and Alfred North Whitehead, culminating in the spiritual empiricism of Bernard Eugene Meland. Meland's theories are then applied to liberal arts education.

The aims of the liberal studies are presented as the development of the individual, the acquisition of wisdom, and the cultivation of the spirit of man. The possibility of accomplishing these aims through the curriculum is investigated. The academic dean is studied as the strategic agent in carrying out such a program.

It is held that the realization of some of these aims can return institutions of higher learning to their distinctive role in society.

192 pages. \$2.50. Mic 57-2394

**AN APPRAISAL OF CURRICULAR AND PERSONAL
COMPONENTS OF THE STENOGRAPHIC TRAINING
OF THE DETROIT HIGH SCHOOL OF COMMERCE**

(Publication No. 20,902)

Leffie Louise Harris, Ed.D.
Wayne State University, 1957

Adviser: Wm. Reitz

Purpose

The major purposes of this dissertation was to evaluate the effectiveness of the stenographic training offered by the Detroit High School of Commerce. The appraisal was concerned with both curricular and personal components of the training.

Methodology

The normative survey was the technique used. A questionnaire was mailed to three parallel groups--graduates with shorthand majors of the graduating classes of June 1950, 1952, and 1954--a total of 223 graduates. Responses were received from 124. An investigation was made to determine whether the respondents and the non-respondents

were homogeneous. It was found that the two groups were similar, but that there was a slight difference in favor of the respondents, particularly with respect to final marks received in English.

Data requested in the questionnaire included pertinent information regarding the activities of the graduates since graduation and their judgments concerning: (1) the value of required courses and the contents of those courses; (2) the effectiveness of the Office Cooperative Program; and (3) the importance of training in the development of personal traits and efficiency factors considered essential to success in business. Comparisons were made of the responses of the graduates grouped by year of graduation and also by the classifications of the positions they held in business as secretaries, stenographers, typists, and clerical workers.

Findings

Since graduation, the graduates have been busy socially with a variety of personal interests and hobbies. Fifty-four per cent have taken some type of additional educational training, either for professional reasons or for better use of personal or leisure-time activities. Professionally, more than 62 per cent of those responding were employed as stenographers and secretaries, most of the others as typists and clerical workers. The median for the total salaries reported was \$254 per month. Their chief duties were: answering the telephone, taking dictation, filing, typing invoices and other forms, receiving callers, typing from copy, and keeping records.

The courses indicated by the graduates as being of most value were typewriting, shorthand, English, and office machines. The phases of training, ranked by 75 per cent or more of the graduates as being of most value, were:

- Capitalization,
- Spelling,
- Punctuation,
- Speed and accuracy in transcribing letters for mailability,
- Knowledge of grammar and sentence structure,
- Making carbon copies, typing envelopes, and
- Making erasures on typewritten copy.

Areas in the curriculum which should receive even more emphasis, according to more than 20 per cent of the graduates, were:

- Word usage and vocabulary building,
- Computing income tax returns,
- Composing original letters and notices,
- Pronunciation and syllabication,
- Knowledge of grammar and sentence structure,
- Penmanship, and
- Drills in addition, multiplication, and other basic fundamentals.

Training in areas ranked by 50 per cent or more of the graduates as being of least value were:

- Making out payrolls,
- Arranging itineraries,
- Emphasizing bookkeeping principles,
- Reconciling bank statements,
- Computing extensions,
- Making train reservations,

Writing letters of application, and
Typing legal documents.

The Office Cooperative Program was praised highly by the graduates; the chief advantages given were: (1) that it was a help in social adjustment and in making friends, (2) that it made school work more meaningful, and (3) that it was helpful in preparation for positions in business after graduation.

Personal traits and efficiency factors receiving a score of 75 per cent or higher with respect to importance in the training offered were:

- Accuracy in work,
- Regular attendance,
- Punctuality,
- Good appearance of work,
- Ability to follow instructions,
- Personal hygiene,
- Appropriate dress and grooming, and
- Responsibility, dependability.

The majority of the graduates praised highly the training they had received in school and recommended that training be continued along existing lines with more emphasis on those areas that had been of most value to them in their work and less on those aspects that had been of least value. More than 50 per cent stated that additional training should be offered with respect to personality development and business etiquette, and that more exacting standards should be maintained by teachers of English and skill subjects. There was an expression also by the graduates that more adequate counseling would be beneficial.

183 pages. \$2.40. Mic 57-2395

WHAT THE PEOPLE OF CHARLOTTESVILLE, VIRGINIA, THINK OF THEIR SCHOOLS

(Publication No. 20,350)

Artley Otho Hutton, Ed.D.
University of Virginia, 1956

Statement of the problem. This study was concerned with what the people of Charlottesville, Virginia, think of their schools. More specifically, an attempt was made (1) to determine the extent of satisfaction or dissatisfaction of parents, teachers, pupils, and non-parent citizens with their schools; (2) to determine which school practices are favored or disapproved by these groups; and (3) to seek out the implications of these findings for school-community relations in Charlottesville.

Methods and procedures. This study is based upon data derived from standardized questionnaires returned by a stratified random sampling of public school parents, by all pupils in grades 4-12, and by the teachers in Charlottesville Public Schools who were present on the day the questionnaires were distributed. The same questionnaire served as a guide in interviewing a stratified random sampling of public school parents. Information was obtained also from a small group of private school parents, a group of non-parent citizens, and members of civic clubs.

Information derived from respondents was organized

and analyzed through the use of tables and discussion. An attempt was made to give added meaning and coordination to the study by means of (1) a list of basic assumptions, (2) a comparison of the results of this study with similar studies in other school systems, (3) the device of relating the implications of the findings to segments of the summary, and (4) coordinating recommendations with the assumptions, the findings, and the implications.

Results. Data obtained in this study indicate that public school parents, teachers, and pupils were satisfied in large measure with the Charlottesville Public Schools. Private school parents and non-parent citizens were less favorably impressed with the school program.

Although a high level of satisfaction existed, some dissatisfaction was noted in such areas as (1) teacher morale, (2) adequacy of salary, (3) methods of teaching, (4) pupils' incidental expenses in school, (5) guidance services, (6) knowledge of school, (7) school discipline, (8) practical value of school work, (9) general housekeeping, and (10) school lunch. These criticisms indicate problem areas from which a number of recommendations have been drawn, principally from a public relations point of view.

Some of the more important implications of this study were:

(1) Since it has been assumed that the teacher is an important public relations agent, any dissatisfaction indicated by poor morale, and/or inadequacy of salary implies the need for satisfactory explanation to the teachers or adjustment of conditions which cause the dissatisfaction.

(2) The relatively low level of satisfaction of parents and pupils concerning the methods of teaching implies the need for organized effort on the part of teachers and supervisors to improve the situation or provide pupils and parents with information necessary to understand the value of the present methods of teaching.

(3) The general concern of teachers, pupils, and parents concerning the excessive pupils' expenses in school with regard to cost of textbooks and other incidental expenses implies a need for immediate effort to make the necessary adjustment or make satisfactory explanation to parents in defense of these costs.

(4) The interest shown by pupils and teachers concerning the need for more help for pupils in the areas of their social problems implies the probable need for more adequate guidance services in this area.

(5) Since it has been assumed that parents get a large part of their information about schools from pupils, special attention should be given to informing pupils concerning the school program and its activities.

Other implications concerning school discipline, practical value of school work, general housekeeping, and school lunch were indicated.

514 pages. \$6.55. Mic 57-2396

A VOCABULARY STUDY OF FOURTH, FIFTH, AND SIXTH GRADE CHILDREN

(Publication No. 20,604)

Joe Henry Loeb, Ed.D.
University of Arkansas, 1957

Major Professor: Jennie Lou Milton

THE PROBLEM

The problem for this study was (1) to determine the extent of the vocabularies of selected fourth, fifth, and sixth grade children through the administration of the Seashore-Eckerson General English Recognition Test, Form 1; (2) to compare the average vocabulary scores of the above children with the average scores of 45,000, 51,000, and 49,500 words found by Dr. Mary K. Smith in her test of the same grades; (3) to determine if such inherent and environmental factors as intelligence, sex, socio-economic status, education of parents, the presence of a radio and television set in the home, and the attitude toward reading have any relationships to the size of meaning vocabularies of the children in the study.

PROCEDURES

The Seashore-Eckerson General English Recognition Vocabulary Test, Form 1, was given to sixty selected children in the fourth, fifth, and sixth grades in Arkansas schools. A comparison was made of these average vocabularies with the average scores found by Smith for these grades in her study. Data collected for determining the relationships between the size of vocabularies and intelligence, sex, socio-economic status, education of parents, the presence of a radio and television set in the home, and the attitude toward reading were obtained from school records, questionnaires, and interviews.

FINDINGS

The average vocabulary scores made by the fourth, fifth, and sixth grade children in the testing program with the Seashore-Eckerson Vocabulary Test were 47,486, 57,618, and 63,630 words. These scores were in harmony with, but slightly exceeded the scores of 45,000, 51,000 and 49,500 words found by Smith for the same grades.

Data collected in this study showed the following: (1) a significant relationship was found between the sizes of vocabularies and intelligence; (2) no significant difference between sex and vocabulary was found; (3) a significant relationship was found between the socio-economic status of the children in the study and the size of their vocabularies; (4) a significant relationship was found also between the education of the parents of the children and the size of the children's vocabularies; (5) as all children reported one or more radios in the homes, no relationships could be determined between the presence of a radio in the home and size of vocabulary; however, no difference was noted between the average sizes of vocabularies of the children with and without television sets; and (6) a significant relationship was found between the attitude toward reading and size of vocabularies.

CONCLUSIONS

The following conclusions were made: (1) more evidence has been added to the assertion that children's vocabularies are much larger than commonly estimated; (2) significant relationships exist between intelligence, socio-economic status, education of parents, and attitude toward reading, and size of vocabularies; (3) no difference exists between the sizes of the vocabularies of boys and girls; and (4) no evidence of a relationship between size of vocabulary and the presence of a television set in the home appeared.

RECOMMENDATIONS

The following recommendations were offered: (1) teachers should develop programs of education to utilize and build the large vocabularies of children; (2) future textbooks for the fourth, fifth, and sixth grades should use larger vocabularies; (3) schools should provide rich, varied experiences so that no children will be doomed to meager meaning vocabularies because of less fortunate socio-economic conditions and parents with limited education; and (4) all elementary schools should give careful attention to developing reading programs that result in enthusiastic interest in reading, since attitude toward reading is closely related to size of vocabulary.

145 pages. \$2.00. Mic 57-2397

enthusiastic, not only in these ratings but in all items. Parents lagged behind considerably in their respective ratings through tests of significance at the one per cent level.

Superintendents of schools were primarily concerned with financing and initiating the camping program, community pressures, proper staffing, and values to the campers. Foremost in the values just mentioned were science learning, health and safety education, development of camper personality and special democratic values.

In summary, part-time camping in Michigan appears to be achieving its aims to a reasonable degree although the importance of the program and its place in the curriculum have not been clearly established. Further attention needs to be given to (1) establishing uniform definitions for school camping, (2) developing effective teaching methods for camp, (3) communicating the values of school camping to all groups and (4) bringing the level of financial support for school camping up to the support given to other educational activities within a school district.

First, it is recommended that the aims for school camping be re-defined in terms of the outdoor setting and that teaching methods be centered around exploration and problem-solving. Secondly, it is recommended that camp movies, planned tours and visitations be used as media for public relations. The purpose of the second would be to illustrate the aims of camping and demonstrate the need for increased financial support.

258 pages. \$3.35. Mic 57-2398

**A COMPARISON OF ASPIRATIONS WITH
ACHIEVEMENTS IN A GROUP OF SELECTED
MICHIGAN PUBLIC SCHOOL CAMPS**

(Publication No. 21,385)

Paul Ernest Rupff, Ed.D.
Michigan State University, 1957

The purpose of this study was to determine what has been achieved by the part-time camp programs in Michigan within the defined needs of a good educational experience. First, it was necessary to form a set of goals or objectives based upon accepted criteria from modern educational experts. Secondly, these goals were then applied to existing camp programs in order to find out how well the specific programs achieved the goals.

The criteria of the study were incorporated into a set of questionnaires which were then submitted to campers, parents, and teacher-counselors within a sample of five public school camps. This phase of the study was followed by a series of interviews on school camping held with eighteen Michigan school superintendents.

Boy camper responses were compared with girl campers as a preliminary breakdown. There were no significant differences except in the case of their reactions toward work tasks and their feeling toward teachers after camp.

The campers felt they ate new foods, followed safety rules, and learned about nature. In addition, they indicated that they enjoyed their stay at camp very much and that within their peer group they learned of an increased need for friends and for skill in getting along with others.

Parents and teacher-counselors tended to agree with the campers but the teacher-counselors were the most

**A COMPARATIVE STUDY OF THE ACADEMIC
ACHIEVEMENT AND SOCIAL ADJUSTMENT OF
TRANSPORTED AND NON-TRANSPORTED
HIGH SCHOOL SENIORS**

(Publication No. 20,352)

Harry Goff Straley, Ed.D.
University of Virginia, 1956

The purposes of this study were to (a) compare transported and non-transported high school seniors as to academic achievement and social adjustment; (b) discover the relationship between academic achievement and distance transported and between academic achievement and length of the school day; (c) determine the attitude of transported seniors toward school transportation; and (d) determine whether there was a statistically significant difference in the extent of participation in extra-curricular activities by the two groups.

The study involved 604 seniors in five high schools in three counties of West Virginia. Schools for the study were selected to include schools of varying size and schools enrolling a fairly large number of both transported and non-transported students, both rural and urban students, and students representing a wide range as to number of miles transported.

Data for the study were secured by administering an intelligence test, a social adjustment inventory, and a personal data sheet completed by each senior. The principal of each school completed a school data sheet and also provided the average of teachers' marks for each senior for the period from the beginning of grade nine through the first semester of grade twelve.

Some of the data gathered were used only as a basis for judging the comparability of the two groups. Conclusions were drawn only from the results of comparisons of the two groups as to achievement test scores and social adjustment inventory scores and comparisons made on the basis of data secured from the personal data sheets.

The data for the 348 transported and 256 non-transported seniors were tabulated and the means, medians, and standard deviations computed for the distributions of the two groups for each item on which comparisons were made.

The t-ratio was the statistical technique used to establish the significance of the differences between means of the distributions. This technique was applied in comparing the intact groups of transported and non-transported seniors as well as for comparing matched samples from the groups. Matched samples consisted of pairs matched by sex and identical I.Q.'s. Conclusions were stated at the one per cent level of confidence.

The Pearson product-moment coefficient of correlation was used to ascertain the relationship between achievement test scores and (a) number of miles transported and (b) length of the school day.

The following conclusions relative to the study appear to be tenable:

1. When unmatched groups of transported seniors and non-transported seniors were compared as to academic achievement, the difference in favor of non-transported groups was statistically significant. When groups of transported and non-transported seniors matched by sex and I.Q. were compared as to academic achievement, there was no statistically significant difference between the groups composed of girls; there was no statistically significant difference between groups composed of both boys and girls; but in the groups composed of boys, there was a statistically significant difference in favor of the non-transported group.
2. When transported seniors were compared with non-transported seniors as to social adjustment, there was no statistically significant difference with either matched or unmatched groups.
3. The correlation between achievement test scores and number of miles transported was statistically non-significant (-.008). The correlation between academic achievement and length of school day was also statistically non-significant (-.005).
4. Only about one-third of the transported seniors thought themselves handicapped by factors incident to transportation.
5. Non-transported seniors participated somewhat more extensively in extra-curricular activities than did transported seniors.

These conclusions would seem to indicate that transportation imposed only slight handicaps upon the transported seniors included in this study.

231 pages. \$3.00. Mic 57-2399

EDUCATION, ADMINISTRATION

A STUDY OF THE EXTENT OF SCHOOL INFORMATION HELD BY VARIOUS OCCUPATIONAL GROUPS IN ARKANSAS AND THE ATTITUDES OF THESE GROUPS REGARDING CERTAIN SCHOOL SERVICES AND EXPENDITURES

(Publication No. 20,601)

William Isaiah Bray, Ed.D.
University of Arkansas, 1957

Major Professor: R. M. Roelfs

The purposes of the study were to compare the extent of school information held by the various occupational groups in certain school districts of Arkansas and to determine their attitudes toward certain controversial topics of education.

Procedure. Data were obtained by interviews in seven school districts in connection with one phase of the Arkansas Cooperative School-Improvement Program. This part of the program, the lay-community study, used teams of interviewers formed from visiting educators of nearby communities and lay people of the host school-community. These teams interviewed as many people as possible in a given length of time. Results were recorded on a prepared checklist immediately after each interview.

The teams reassembled for oral reports and discussion. The marked checklists were collected by the investigator who compiled a report for the host school and the visiting educators who participated in the study. The data collected in the various studies were kept and combined for further analysis in this study.

A pilot study was made in one of these communities and was completed two weeks before the holding of the lay-community study in that district. A random sample was drawn, interviewed by the investigator, and alternate interviews were recorded while the interview was in progress. Comparisons were made within the pilot study to determine the relative efficacy of recording results immediately after the interview. Comparisons were made between results of the pilot and lay-community studies in the same community to indicate the reliability of methods used in the lay-community study.

Findings and implications. Recording interviews immediately after they were completed produced the same results as did recording while the interview was in progress. Methods used in the lay-community study gave the same results as were obtained in the pilot study using a random sample and a single interviewer. Apparently local districts can secure a fairly accurate indication of patrons' attitudes and information without the more elaborate preparations required for a random sample.

Information ratings differed among the occupations. Business and professional groups knew most about the schools; farmers and housewives knew the least. From this it follows that school information programs should be made especially receptive to farmers and housewives (about 50 per cent of the people) but should not neglect other groups.

Generally, the desire for more school services decreased as the size of the school increased.

Satisfaction with the schools was positively related to attitudes toward higher local school taxes but not related

with attitudes regarding federal aid. The people who were for higher local taxes tended to be the same people who were for federal aid. School support appeared to be related to satisfaction with the schools. People favored federal aid to improve the schools, not primarily to reduce local taxes.

The people most informed on school support tended to favor federal aid. Implication: staunch supporters of federal aid legislation will most likely be found among the well-informed on school support.

Business and professional people were best informed regarding course offerings. Farmers were least informed. This implies that many people do not know what the schools are offering and that public information efforts by-pass some groups.

Patrons knew no more about school personnel than about other topics. This implies that association within the community does not insure dissemination of information and that a comprehensive approach is needed.

Individuals' extent of information and satisfaction varied directly. This implies that one way to achieve better satisfaction would be to provide the people with more information.

190 pages. \$2.50. Mic 57-2400

ORGANIZATION, PROGRAMMING, AND PERSONNEL POLICIES OF THE COOPERATIVE EXTENSION SERVICE IN SELECTED STATES

(Publication No. 20,622)

Glenwood Lewis Creech, Ph.D.
The University of Wisconsin, 1957

Supervisors: Professors Robert C. Clark
and Bryant E. Kearn

This study was designed to describe the organization, programming, and personnel policies of the Cooperative Extension Service in selected States. A further objective was to identify basic principles of organization and administration which have been applied in two State Extension Services.

The North Carolina and Maine Extension organizations were selected for this case study. These two States were selected to provide differentiation in geographical representation, philosophy of extension, organizational pattern, program planning procedure, size of staff, supporting budget, and other factors pertinent to an effective extension program.

A descriptive-survey case-study approach was used in both States. A team of three members visited each State during the summer of 1956. The team collected and analyzed all pertinent written material and held interviews with various members of the State and county staffs. Persons interviewed were asked to recommend changes, which they thought would improve the functioning of the State Extension Service. Their recommendations were summarized and suggest to extension administrators areas which might, if given consideration, be productive of increased organizational efficiency.

Based on data gathered in the States, conclusions were drawn using as a frame of reference selected principles concerning organizational structure and administration. Only qualitative interpretations were made.

Conclusions

1. The principles of organization and administration set forth in current literature are applied in varying degrees in the State Extension Services.
2. Both State Extension Services studied have a hierarchical organization structure.
3. The size of the State Extension Service determines in a large measure the number of hierarchical levels in the organization structure. The more dispersed the extension field workers are and the larger the extension staff and supporting budget, the greater is the need for assistant directors in addition to State leaders, for supervisors, and for a sizable specialist staff.
4. The clarity of relationships of persons in the two organizations studied was directly related to the size of the organization and the number of its hierarchical levels.
5. Both State Extension Services provided for both line and staff functions.
6. The smaller extension organization had a higher ratio of staff to line personnel than the larger organization.
7. Both State Extension Services have individuals who are directly or indirectly responsible to more than one person.
8. There was no evidence to confirm the alleged bad effects of dual supervision.
9. The Cooperative Extension Service is not at all consistent as to span of control, and has not defined the limit for any supervisor.
10. For nearly all positions in the two State Extension Services there were cases of responsibility delegated without commensurate authority.
11. Both State Extension Services have recruitment programs, but these programs are not always adequate to insure a continuous supply of suitable candidates for all positions.
12. Both State Extension Services have training programs for their personnel based upon their expressed needs but differed widely in organization and nature of training.
13. Neither organization provided systematic inservice training opportunities for those persons in the top levels of the extension hierarchy.
14. The Cooperative Extension Service does not always provide clear-cut job descriptions and standards of performance for each position.
15. The Cooperative Extension Service does not always provide clearly defined salary and promotion policies.

Recommendations

The principal recommendation from this study is that principles of organization and administration be reexamined and in some instances new principles set forth to characterize more accurately the organization and operations of the Cooperative Extension Service.

268 pages. \$3.45. Mic 57-2401

AN APPRAISAL OF PLANS FOR EVALUATION OF THE INTERN AND THE INTERNSHIP IN EDUCATIONAL ADMINISTRATION

(Publication No. 21,520)

Regina Isabelle Fitzgerald, Ed.D.
University of Maryland, 1957

Supervisor: Clarence A. Newell

An appraisal of plans followed in the evaluation of the intern and the internship in educational administration was one of six doctoral studies undertaken in an appraisal of the effectiveness of internship programs at universities in the Middle Atlantic Region of the United States in the preparation of educational leaders. The purpose of the study reported here was to appraise plans of evaluation in order to discover strengths and weaknesses and to suggest revisions or additions which would seem to make evaluation more effective.

A study of research concerned with the internship in educational administration, the evaluation of teaching and student teaching, and the evaluation of leadership was undertaken to provide a basis for the development of evaluative criteria.

The preliminary criteria were presented for criticism and validation to a panel of nine educational leaders who had had wide experience in the evaluation of a number of different educational programs. The suggestions of the panel members led to the revision of the evaluative criteria. The final list of criteria was organized around continuous, cooperative, comprehensive evaluation of the intern's competence as an educational leader.

A preliminary survey of universities in the Middle Atlantic Region was made to determine the programs of internship to be included in the study. Nine of the universities indicated that they had no internship program or that the program had not progressed to the point where an evaluation would be profitable. The University of Pittsburgh; New York University; Teachers College, Columbia University; and the University of Maryland agreed to cooperate in the appraisal.

Directors of internship programs at these four universities supplied information on the organization of their program and the plan followed in the appraisal of the intern and the internship. Additional information was secured from cooperating administrators, interns, and former interns through interviews and correspondence.

The information was analyzed by means of the criteria to determine the strengths and weaknesses in the total plan for evaluation. Suggestions were then made for revisions or additions which would seem to make evaluation more effective. The study identified common practices in evaluation and a suggested comprehensive plan for evaluation of the intern and the internship program was developed.

300 pages. \$3.85. Mic 57-2402

CRITICAL AREAS OF ADMINISTRATIVE BEHAVIOR OF CITY SCHOOL SUPERINTENDENTS

(Publication No. 21,437)

John Elwood Hartzler, Ph.D.
The Ohio State University, 1956

The research involved an examination of ten critical areas of administrative behavior of city school superintendents. These areas included: (1) appraising effectiveness; (2) communicating; (3) coordinating administrative functions and structure; (4) determining roles; (5) fostering human relations; (6) involving people; (7) making and maintaining policy; (8) setting goals; (9) using the educational resources of the community; and (10) working with community leadership to promote educational improvement.

The Problem

The problem of the research was to determine whether the administrative behavior of city school superintendents could be described and analyzed within the framework of the ten critical areas and whether differences between the administrative behavior of a group of superintendents rated "most effective" and the administrative behavior of a group of superintendents rated "least effective" could be identified by means of the category system.

The Method

The behavioral data analyzed were gathered by direct observation of ten city school superintendents as they functioned in their own administrative situations. Five superintendents had been previously and independently rated as "most effective"; five had been rated as "least effective." Four observation periods, with a total time equal to about two and one-half days, were provided for each superintendent.

From anecdotal records prepared for each observation period, 4,190 units of administrative behavior were extracted and categorized according to operational definitions for each critical area and for subcategories within each area. Frequency tabulations of behaviors, by individuals and by groups of superintendents, were made for categories and for subcategories. The characteristics and the discriminative properties of the category system and of each critical area were determined by descriptive analysis and by application of the Chi-square test and the *t*-test.

The Findings

The category system was found to be useful in analyzing the observed administrative behavior. Each of the 4,190 units of behavior was classified in one of the critical areas. Quantitative and qualitative differences between the behaviors of the two groups of superintendents were identified by means of the category system.

Significant behavioral differences between the two groups of men were found in the critical areas of determining roles, involving people, and working with community leadership to promote educational improvement. The most effective superintendents exhibited the higher frequencies of behavior in each of these categories.

Differences between the behaviors of the two groups of superintendents were also identified through subcategory analysis in each of the ten critical areas. Thirty differences were identified by application of the Chi-square test. Thirty-nine differences became apparent as a result of descriptive analysis.

The Conclusions

It was concluded that the critical-areas approach is one way of studying administrative behavior. It was also concluded that the principal difference between the behaviors of the most effective and the least effective superintendents was to be found in the manner in which the superintendent brought the activity of other persons to bear upon the accomplishment of educational objectives. The two groups of superintendents differed in their leadership acts of organizing, directing, and sustaining co-operative action for achievement of educational goals.

420 pages. \$5.35. Mic 57-2403

**A STUDY OF PUBLIC SCHOOL TRANSPORTATION
IN ARKANSAS**

(Publication No. 20,603)

Joe E. Kuklenski, Ed.D.
University of Arkansas, 1957

Major Professor: Roy B. Allen

Purpose of the Study

The purpose of this study is to ascertain and analyze certain of the methods and procedures used by local boards of education in the state of Arkansas in providing transportation for the public school pupils, and to compare these practices with recommended procedures of selected authorities in this area of educational administration.

Method of Research

Analysis of data obtained from information blanks sent to executive officers of local boards of education in the state of Arkansas, interviews with classroom teachers in Arkansas, and a review of related literature in the area of administration and management of public school pupil transportation were made.

Summary

Practices and procedures reported to be used by local boards of education in Arkansas in administration and management of pupil transportation were contrasted and compared with the opinions and recommendations of selected authorities in educational administration.

Practices and procedures were contrasted and compared in these areas:

1. Local school board policy. 2. Bus purchasing. 3. Contracting for transportation services. 4. Transportation records. 5. School bus routing. 6. Related pupil transportation activities. 7. Relationship of parents and pupils to the transportation program. 8. Educational opportunity.

Conclusions and Recommendations

Local boards of education in the state of Arkansas should give serious consideration to the following desirable practices in the administration and management of pupil transportation programs:

LOCAL SCHOOL BOARD POLICY

1. Adoption of specific policies with regard to the pupil transportation program and making these policies in written form and a matter of school board record. 2. Defining what is considered a reasonable walking distance for children of different age groups. 3. Extension of pupil transportation for physically handicapped children who might benefit from public education. 4. Working with local school bus drivers in developing a set of operating rules for bus drivers that take into consideration local conditions.

BUS PURCHASING

1. Making more long-range plans for purchasing additional equipment and replacements for old equipment. 2. Purchasing new equipment at times other than during the summer months.

CONTRACTING FOR TRANSPORTATION SERVICES

1. Giving more attention to written contracts, surety bonds, liability insurance, and inspection of contracted vehicles.

TRANSPORTATION RECORDS

1. Keeping individual records for each bus in the fleet. 2. Preparing monthly reports indicating the operating costs for each school bus. 3. Keeping better records on substitute bus drivers. 4. Keeping more comprehensive records on instructional and other non-route trips.

SCHOOL BUS ROUTING

1. Keeping spot maps of the local school district which clearly indicate all pupils as either secondary or elementary school students. 2. Reducing the distance that children must walk to school and to bus routes. 3. Reducing the length of the school day for transported students. 4. Co-operating with officials responsible for the construction and maintenance of roads on which school buses travel by giving these officials copies of bus routes and time schedules. 5. Assigning buses to each route that are appropriate in terms of capacity.

RELATED PUPIL TRANSPORTATION ACTIVITIES

1. Re-examining the practice of designating special sections of classes and special elementary classrooms for transported children.

RELATIONSHIP OF PARENTS AND PUPILS TO THE TRANSPORTATION PROGRAM

1. Adequately informing parents of transported children of services to be rendered and the rules their children are expected to follow.

EDUCATIONAL OPPORTUNITY

1. Including an evaluation of the pupil transportation program as a part of the total program of public school classification. 2. Considering the nutritional needs of transported children by providing morning and afternoon nourishment. 3. Giving attention to curriculum development in the area of safety education with special emphasis on the bus trip. 4. Considering the possibility of reopening closed elementary attendance centers when by so doing the transported children would be benefited. 5. Planning and making a comprehensive and adequate program of pupil transportation available to children affected before considering any future reorganization of school districts.

160 pages. \$2.10. Mic 57-2404

A STUDY OF THE EDUCATIONAL OPINIONS OF STUDENTS, PARENTS, AND TEACHERS OF A LOCAL SECONDARY SCHOOL

(Publication No. 20,906)

Arthur Matthews, Ed.D.
Wayne University, 1957

Adviser: Roland C. Faunce

This research is a survey of the opinions of students, parents, and teachers of Royal Oak, Michigan, with reference to the curriculum of the senior high school. Students, parents, and teachers responded anonymously to an opinion questionnaire based on the Ten Imperative Needs of Secondary Youth.

The purpose of the study was (1) to determine whether curricular practices of the local senior high school, in the opinion of respondents, were in harmony with the established needs of youth, and (2) to propose curricular improvements which would be adaptable to the needs of local youth.

The basis for the study is to be found in the beliefs underlying the structure of the study: (1) continuous curriculum examination and readjustment are necessary if the school's program is to meet changing conditions and their resulting problems; (2) curriculum change is a form of social change; (3) curriculum planning should be a local-school-community task; (4) curriculum planning as a social process should involve widespread participation and thorough understanding on the part of all interested individuals and groups; and (5) opinions and ideas held by parents and students can be important influences in the development of a high school curriculum.

Briefly, the method used in this investigation consisted of the administration of an opinion inventory to students of the senior class, parents of the students, and teachers of the senior high school. Part one of the survey instrument comprised thirty-two different items, each of which listed six possible alternatives to be checked. Part two included four questions of the free-response type.

The chi square test of homogeneity was used to test the significance of such differences as were observed among the subject groups. For the purposes of this study, a p of .05 or less was adopted as a criterion to indicate the likelihood of a difference in response between the compared groups that was not ascribable to chance.

The findings of this study are applicable only to situations similar to the sample used. However, in the opinion of this investigator, the needs of these students are not unusually different from those of thousands of other students of the same age.

Conclusions of the Study

1. The high school program is still too much influenced by traditional patterns rather than an interest in the established needs of youth.
2. There is a lack of understanding on the part of teachers, or at least an unwillingness to become concerned over the personal problems of students.
3. The most significant aspect of the curriculum in the school is that basically it is synonymous with the course of study.
4. When respondents were asked for their suggestions

for improvement of the school offerings, they gave evidence of student needs in the fields of vocational guidance, educational guidance, sex and marriage problems, and better teacher-pupil relationships.

5. There is no evidence of specific plans being made by anyone for spelling out the aims of the school in terms of specific series of life-learning experiences.

On the basis of the data obtained from this study, the following recommendations are made for improvement of the program of Royal Oak Senior High School:

1. There should be a broad expansion of offerings in the useful arts, including commercial work, vocations, homemaking, and the various avocational arts and crafts.

2. A closer relationship should be established between the educational program and the essential needs of the community.

The general conclusion of the study is that the job of secondary education is to help youth to make a present and future adjustment to adult society which will enable them to function effectively in the various life areas in that society.

279 pages. \$3.60. Mic 57-2405

THE USE AND FUNCTIONS OF MULTI-PURPOSE ROOMS IN SANTA CLARA COUNTY, CALIFORNIA

(Publication No. 21,561)

Stanley Daniel McDougall, Ed.D.
Stanford University, 1957

Statement of The Problem.

The purposes of this study were:

1. To make an exploratory study into the nature and amount of use multi-purpose rooms receive in Santa Clara County, California.

2. To determine if the use such rooms receive is in essential agreement with practices recommended by educational authorities.

3. To determine if educational and community leaders who use such facilities have found deficiencies in the characteristics of such rooms which can be remedied.

Procedure.

The study was conducted for four consecutive weeks during the spring, four consecutive weeks during the fall, and four consecutive weeks during the winter of the calendar year, 1955.

The nature and amount of usage elementary school multi-purpose rooms receive was determined by placing a "Calendar of Use" in every elementary school multi-purpose room located in Santa Clara County, California. The building principal of each school was given the responsibility of seeing that every use of the room was recorded upon the calendar.

Factors that contributed to the nature or amount of use such rooms received were determined through the means of a questionnaire (Questionnaire "A") that was completed by all building principals.

Recommended practices were determined by two methods:

1. Reviewing literature in the field, and
2. Summarizing opinions obtained through the means of a questionnaire (Questionnaire "B") that was completed

and returned by 35 state, 12 county, and 17 local educational authorities.

The actual usage of these rooms was then compared with the practices recommended by the above listed methods.

A total of 212 teachers, 55 principals and 281 leaders of community groups returned a third questionnaire (Questionnaire "C"). This questionnaire was designed to survey the opinions of people who use these rooms as to the success of the rooms in meeting certain housing needs of both the educational program and community groups.

The results obtained from the educational personnel were treated apart from the results obtained from community groups.

Results.

Results of the study indicated:

1. Elementary school multi-purpose rooms are generally used to meet the following needs:

- a. Lunch
- b. Assembly
- c. Music
- d. Audio-visual Education
- e. Physical Education
- f. Faculty Usage
- g. Extended Classroom Activities
- h. Dramatics

2. The usage elementary school multi-purpose rooms receive from both educational and community groups tends to be in essential agreement with practices recommended by educational authorities.

3. A varying degree of success in meeting certain housing needs of the educational program and the community. In the opinion of the majority of educators multi-purpose rooms achieve their greatest success in meeting the needs of the primary grades, and the least amount of success in meeting the more specialized needs of upper grade curriculum.

Community leaders of suburban communities reported the highest degree of satisfaction (85%) with the facilities found in elementary school multi-purpose rooms. In urban communities 82% of such leaders reported similar satisfaction, while only 65% of such leaders in rural communities expressed satisfaction with such facilities.

Conclusions.

Conclusions reached by this study indicate:

1. Multi-purpose rooms are being used for a wide variety of purposes in Santa Clara County, California.
2. The manner in which they are used is in essential agreement with the type usage suggested by educational authorities.
3. Some dissatisfaction with the characteristics of such rooms; however, it was noted that (in the opinion of the majority of educators and community leaders who have occasion to use such rooms) elementary school multi-purpose rooms are meeting satisfactorily certain housing needs of the educational program and the community.

184 pages. \$2.40. Mic 57-2406

CRITICAL AREAS OF ADMINISTRATIVE BEHAVIOR OF LOCAL SCHOOL EXECUTIVES

(Publication No. 21,449)

David Seward Rosenberger, Ph.D.
The Ohio State University, 1956

The hypotheses for the study were (1) that the critical areas of administrative behavior postulated by the School-Community Development Study do exist in administrative situations occurring in schools served by local school executives (local superintendents), and the behavior in these situations can be described within the framework of the critical areas, and (2) that the administrative behavior of executive heads judged to be more effective will vary quantitatively and qualitatively within the critical areas from that of executive heads judged to be less effective.

The names of executive heads of local school districts in seven counties were sent to a panel of thirty-four jurors who rated the men they knew on the quality of "over-all administrative effectiveness." Two groups, the more effective and the less effective administrators, were formed from the results of the balloting. Each administrator was observed for not less than two and a half days as he went about his work, and his behavior was recorded by the observer.

The data gathered in the observations were broken down into units of behavior. Each of the 2,241 units of behavior produced was placed in a critical area in accordance with its conformity to the definition of the area in which it was placed. A random sample of the units of behavior was submitted to other persons, and since differences in these categorizers' results were not statistically significant, a high reliability of categorization was indicated.

It was concluded that the nine critical areas of administrative behavior did not fully describe all the observed administrative behavior, but that some behavior in each of the areas did exist in varying degrees. One critical area, Fostering Human Relations, was added to the list.

Some categories were more dominant than others in terms of frequency of behavior. Two critical areas, Determining Roles and Coördinating Administrative Functions and Structure, showed significant statistical and descriptive differences between more effective and less effective administrators. One critical area, Communicating, showed a statistical difference approaching significance and a marked descriptive difference between the two groups of administrators. In all three areas, the less effective administrators had the greater frequency of behavior. Five critical areas showed marked descriptive differences.

These were: Appraising Effectiveness, Fostering Human Relations, Involving People, Making and Maintaining Policy, and Setting Goals. These eight areas were retained in the critical area framework. Two critical areas, Using the Educational Resources of the Community and Working with Community Leadership, were dropped from the framework since they showed no significant statistical or descriptive differences. It was suggested that they be studied further.

It was concluded that the more effective administrator is cognizant of the opinions of others as he considers problems, initiates ideas, holds goals clearly in mind, gives sincere compliments freely, and is able to delegate authority. The less effective administrator spends a large share of his effort on office routine and records, takes

care of a multitude of problems as they arise, allowing his schedule to be governed by detail and trivia, and tends to be critical of the persons with whom he works.

The less effective administrator works with students, while the more effective administrator works with teachers, more than any other class of persons. The less effective men tended to move at a rapid order, going from one person or subject to another in quick succession, while the behavior of the more effective is deliberate and more considered in relation to problems and people.

The critical area framework is a way of organizing administrative behavior. With further study, the taxonomy can be a real contribution to a theory of educational administration.

236 pages. \$3.05. Mic 57-2407

While there appeared to be a need for leadership exercised by the superintendent of the intermediate district the study indicated that there was a wide gap between the need for leadership in most counties and the extent to which the need was being satisfied by the county superintendent.

There appears to be a need for an intermediate unit in the structure of the administrative control of education in Michigan. It should be modified in some sections of the state to make larger intermediate units capable of more nearly providing the functions required from them. In the evolution of more functional intermediate units the Department of Public Instruction should provide the leadership to lay and professional groups as they seek to find ways of adapting the county office of education to improve the educational opportunities in the state.

271 pages. \$3.50. Mic 57-2408

A STUDY OF SELECTED FUNCTIONS OF THE COUNTY SCHOOL OFFICE IN MICHIGAN

(Publication No. 21,386)

Colon Lee Schaibly, Ed.D.
Michigan State University, 1956

The problem. The study had as its problem to explore the need for the county office of education in Michigan in terms of services which should be provided to local districts and assistance which should be given to the state educational authority; to ascertain the type of duties being performed by the county office of education in Michigan today; and to examine the selection, composition, and functions of the county board of education.

Method, technique, and data. Data were collected from school administrators at three levels - the state, the county, and the local school district through personal interviews and mailed questionnaires. Interviews were conducted with twelve representatives of the Department of Public Instruction, and with twenty county superintendents of schools, selected by a random, stratified sampling process from the eighty-three county superintendents in the state. In addition to those selected, the superintendents of Wayne and Oakland counties - the most populous in the state - were interviewed. Their responses were recorded separately. Questionnaires were mailed to 152 (25 percent) of the superintendents of local school districts selected in a similar manner to assure a random, stratified sampling of that group. Of the 152 questionnaires distributed, 120, or 78.9 percent, were returned in time to be included in the tabulations.

The data, both objective and subjective in nature, which was obtained from the three types of respondents included information on such items as: services performed by the county superintendent for local school districts; composition of the county board of education; and the county school office as an arm of the state educational authority.

Findings and conclusions. In response to the need for educational services in local schools to realize equal educational opportunity for all children, the county offices of education in Michigan have shown extreme variation in the extent to which they have been able to provide for the unmet educational needs. There was no clear agreement in the state as to what the service function of the county school office should be.

AN ANALYSIS OF THE RELATIONSHIPS BETWEEN EIGHT FACTORS AND THREE MEASURES OF QUALITY IN THIRTY-NINE SOUTH CAROLINA SECONDARY SCHOOLS

(Publication No. 20,779)

Herman Walker Shelley, Ed.D.
The University of Florida, 1957

Purpose of the Study:

The purpose of this study was to investigate the possibilities of improving the quality of school systems through the exertion of positive elements of control over the direction of change in factors which may be shown to be related to the quality of education.

This study attempted to answer the following questions:

1. To what extent may the variability in quality among school systems be ascribed to variations among certain designated factors?
2. What are some elements, or influences, which may be employed to exercise control over the direction of change in factors related to quality, in order that the school system may be improved?

Therefore, the major hypothesis of this study was that certain controllable factors could be identified, which affect variations in school quality.

Design of the Study:

The procedure in this study was to analyze the relationship between the quality of thirty-nine South Carolina secondary schools, as measured by three separate criteria, and eight factors which are commonly assumed to affect quality. In order to investigate this problem statistical analysis was made of the relationship between the following:

1. School quality as determined by ratings based on the Evaluative Criteria--1950 Edition and (1) average salary of the teachers, (2) teacher certification, (3) scope of the educational program, (4) school size, (5) quality of administration, (6) condition of the plant facilities, (7) socio-economic level of the community, and (8) the amount of money spent for instruction per teacher in the school.
2. School quality as determined by holding power and each of the eight factors listed above.
3. School quality as determined by a jury of state supervisors and each of the eight factors listed above.

4. School quality as determined by an index of quality (statistically computed by using the three quality criteria mentioned above) and each of the eight factors listed above.

Conclusions:

Within the limitations of this study, which included twenty-nine white schools and ten Negro schools, the following conclusions have been reached:

1. Sixty-nine per cent of the variance of school quality is accounted for by variation in school size, scope of the educational program, plant facilities, administration, socio-economic status of the school-community, average teachers' salaries, certification of teachers, and teacher instructional expenditure units; and, thirty-one per cent of the variance is accounted for by variables other than these.

2. The two most important factors affecting school quality are: the scope of the educational program and the calibre of the administrative leadership.

3. School size is an important factor that affects school quality, but it is of lesser importance than the scope and the administration.

4. There is little or no relationship between school quality and the socio-economic status of the school-community in South Carolina.

5. The assumption that a certain amount of training required for certification will improve the quality of teaching is supported.

6. School plant might be considered a very important determiner of school quality when the plant facilities of an area are unequal and in poor condition.

7. There is a very high relationship between certification of teachers and the average salary of teachers in South Carolina.

8. An "index of quality," statistically computed is a better measure of quality than any one of the three considered separately.

9. The three quality criteria, according to their validity as measures of school quality, rank as follows:

1. Evaluative Criteria Ratings.
2. Supervisors' Ratings.
3. Holding Power.

10. When the three quality criteria of supervisors' ratings, Evaluative Criteria ratings, and holding power are used to measure school quality, the proper beta weights for each should be approximately as follows:

Evaluative Criteria Ratings	2.96
Supervisors' Ratings.	1.77
Holding Power.89

11. When professional educators evaluate the quality of schools, they are overly-influenced by the size of the school.

325 pages. \$4.20. Mic 57-2409

A STUDY OF TEACHER PERCEPTIONS OF SELECTED SCHOOL DEVELOPMENTS AND THEIR IMPLICATIONS FOR THE LEADERSHIP ROLE OF THE PRINCIPAL IN THE GRANT SCHOOL, FERNDALE, MICHIGAN

(Publication No. 20,911)

Charles E. Stewart, Ed.D.
Wayne State University, 1957

Adviser: Roland C. Faunce

Purposes and Procedures of the Study

This investigation dealt with perceptions of one school faculty in regard to sixty-two school actions which teachers selected for study. Essentially, the immediate purposes of the study were (1) to determine relationships between teacher valuation of an action and teacher perceptions of the action's origin; (2) to determine relationships between teacher valuation of an action and teacher perceptions of personal involvement in the action; and (3) to compare teachers' and principal's perceptions of value, origin, and teacher involvement. Basic to the purposes was a desire of the investigator to improve his role as principal of the school. Implicit also was the principal's belief that his exercise of leadership must be influenced greatly by the perceptions of his teacher co-workers.

The initial inventory of school actions observed two criteria: (1) the actions were initiated by "some person or group of persons" in the Grant School; and (2) the actions had "some significant effect upon policy, practice, or the general welfare of the school or its community." The investigator eliminated actions mentioned only once, reducing the original inventory to sixty-two actions. More than half of the finally selected actions were not of a school-wide nature; that is, they were developments for which an individual or a small group of persons assumed total responsibility.

Teacher perceptions of the selected actions were indicated on three check lists administered in a staff meeting where the purpose of the project and the specific intent of each check list were discussed. In this meeting, grounds were established for later staff study of the findings. The check lists were designed to determine how teachers rated actions on a five-point scale from "no value" to "highest value"; personal involvement of teachers with regard to "being informed," "planning," and "action"; and whether teachers considered actions as initiated by the principal, another teacher or committee, or by themselves personally.

Some Findings of the Study

Substantial teacher majorities indicated the principal to be the initiator of twelve actions against thirty-eight thus designated as teacher initiated. There was not substantial teacher agreement on an initiator for the remaining twelve actions. A more intensive analysis was made of four groups of actions established on the basis of values assigned by teachers. Two of these were composed of the ten highest and ten lowest rated actions respectively. The other two, numbering nine each, comprised the upper and lower thirds of the twenty-seven "school-wide" actions included among the sixty-two. Examination of these selected groups revealed that actions "initiated by teachers" were rated slightly higher than those "initiated by the principal." However, for all actions a consistently high percentage of respondents "did not remember" the initiator.

For all actions, an average of nearly 90 percent of the respondents felt they "were informed." Moreover, for this aspect of involvement the percentage remained constantly high regardless of the ratings assigned the actions. It is interesting that, for all sixty-two actions, an average of 55 percent of the respondents felt they had participated in the action itself, but for the ten actions rated lowest by teachers a slightly higher average percent of teachers indicated participation in the action. Of the three aspects of involvement considered, "sharing in planning" bore the most consistent relationship to high teacher valuation.

Teachers' value ratings varied as much as four scale points for most of the actions, but the principal tended to agree on the relative value of actions under study, although his ratings almost always were higher than the averages of varying teacher ratings. Teachers and principal concurred also on designations of who was the action initiator in the lowest rated items but not in the highest ranked items. A consistently high percentage of teachers agreed with the principal that they "were informed" about actions. However, in the planning and action aspects of involvement, the principal's perceptions concurred with the teachers' more frequently among the highest rated actions than among the lowest.

Some Conclusions

First, in the situation studied, teacher valuations of action were influenced to some extent by factors other than that of who initiated the action and/or personal participation in the action. Second, the Grant teachers feel free to plan and initiate action. Third, teacher participation may have given effectiveness to certain actions without affecting their value as seen by teachers.

A fourth and all-embracing conclusion might be stated as follows: Many factors in a school situation may combine to produce high morale. High morale may be conducive to feelings of ownership in school actions generally, regardless of the initiator or personal participation. In such a situation truly cooperative planning might completely obscure the initiator of resultant action. Furthermore, high teacher morale forms an important basis for a real personal involvement which is closely related to individual personal values.

180 pages. \$2.35. Mic 57-2410

THE FUNCTIONS AND RESPONSIBILITIES OF DISTRICT LEADERS IN THE CO-OPERATIVE EXTENSION SERVICE IN WISCONSIN

(Publication No. 20,651)

Gale LeRoy VandeBerg, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Walter Bjaraker

Purposes

The general purposes of this study were to: (1) provide the administrators of the Co-operative Extension Service in Wisconsin with valid information upon which to base future decisions regarding district leader work; (2) help district leaders better understand their roles in an

expanding program and organization by obtaining information upon which to base their decisions; and (3) help county extension agents, specialists, and district leaders better understand relationships to each other by obtaining information that would aid in developing such understandings.

Procedures

Factual data and opinions were gathered in January, 1956, by a questionnaire administered at district and state meetings of all co-operative extension personnel in Wisconsin. Data were analyzed by extension positions, districts, and state totals and averages.

This investigation was initiated by a committee of extension workers appointed by the Associate Director of the Co-operative Extension Service in Wisconsin. The writer attempted to incorporate this committee's desires for information in a detailed questionnaire which was designed to gather similar information on specialist functions in Wisconsin at the same time. Data regarding the specialists is to be analyzed separately.

Conclusions

1. Wisconsin has more county extension agents per supervisor than other states in the North Central Region.
2. Experience as a county extension agent and special training to the master's degree level are essential for supervisory personnel.
3. The ten most important functions of supervisors, of the twenty-five studied, are: a. Counseling and working with new personnel in counties during their first year of employment. b. Recruiting and 'screening' new personnel. c. Interpreting extension policies and procedures. d. Training and guiding agents in program planning. e. Helping agents evaluate their methods and results. f. Planning and conducting state and district conferences and events. g. Guiding and informing county agricultural committee members. h. Acting as liaison between county personnel and other state personnel (specialists, administrators, research). i. Improving personnel relations within counties. j. Helping agents appraise themselves.
4. The most important functions are generally being performed better than those of less importance with three exceptions.
5. There is little relationship between extension workers' opinions on importance of district leader functions and their number of years of experience in extension work.
6. There is a high degree of consistency among extension workers' opinions as to the importance and performance of the various functions of district leaders.
7. Extension agents in Wisconsin do not think it necessary nor desirable to employ an additional district leader in each district to perform only administrative type functions with the others performing only supervisory type functions.
8. Smaller districts and more district leaders are necessary if district leaders are to properly carry out desired functions.
9. Extension agents received an average of 5.5 visits from district leaders during the past year. Home agents received the most visits and farm and home development agents received the least.
10. No extension agent in the State desires less visits from district leaders.
11. Regularly scheduled visits to agents is the most preferred means of providing district leader help.
12. There is no one time in the program sequence when district leader help is of significantly more importance than any other.
13. There is little

overlapping of activities among the different types of district leaders. 13. It is proper and desirable for state personnel to suggest projects for county programs if such suggestions are made before county program planning time each year.

Recommendations

Some of the recommendations resulting from this study were:

1. At least five extension districts should be created with a district leader in agricultural, home economics, and 4-H club work in each district. 2. Complete job analyses resulting in detailed job descriptions should be carried out throughout the Extension organization. 3. A formal system of personnel performance rating should be developed to supplement present informal methods. 4. Staff members, trained in personnel management should be assigned to the development and maintenance of improved devices and techniques for recruitment, selection, job analyses, personnel audits, and personnel performance rating.

208 pages. \$2.70. Mic 57-2411

A PROPOSAL FOR SCHOOL DISTRICT ORGANIZATION OF LAKE COUNTY, CALIFORNIA

(Publication No. 20,440)

George Edward Weekes, Jr., Ed.D.
Stanford University, 1957

In California the State Board of Education has assumed leadership for effecting school district reorganization. In statements of policy the state Board of Education has indicated that it is its intent and expectation that the plans for school district reorganization for the State of California will provide for a series of well-organized unified districts.¹

Purpose of the Study

The general purpose of this study is to compare the present school district organization in Lake County with what is considered to be a good school district organization in accordance with the criteria proposed by the California State Board of Education and the State Department of Education, and to ascertain the probable effects on the educational program in Lake County of such school district reorganization.

If, after thorough examination, it has been established that school district organization in Lake County could result in an improved educational program, then a schematic proposal will be presented based upon the criteria advocated by the State Department of Education and the State Board of Education.

Criteria to be Used

A statement of criteria upon which the redistricting of Lake County could be determined should be made. Such a statement of criteria follows:²

1. The reorganized school districts should be a unified school district providing education through grade 12.
2. The reorganized school district should preserve community integrity.

3. The reorganized school district should utilize existing sites and buildings where possible.
4. The reorganized district should be as flexible as possible.
5. The reorganized school district should be able to operate within a strong intermediate county organization.
6. The proposed reorganized school district, must as nearly as it may be determined, meet general public approval.

Additional factors, after thorough examination, will determine whether a district or districts, should be reorganized.

1. Is complete elementary and secondary educational services for all persons of educable ability provided?
2. Does the school district or districts provide well qualified educational and financial leadership, as well as necessary educational services?
3. Is the greatest possible equalization of assessed valuation per pupil provided?
4. Is the district's bonding capacity large enough to ensure adequate school building construction?

Recommendations

After careful examination of the data, no existing school district satisfied the criteria as established by the study.

The researcher proposed that the entire county be unified into a single unified school district. The plan was acceptable for the following reasons:

1. There would be a greater equalization of tax burden.
2. An educational program would be provided at a reasonable cost designed to meet the needs and requirements of all children of school age.
3. Able and efficient leadership and adequate special services could be provided at a reasonable cost.
4. Better articulation.
5. Attendance centers could be maintained in existing social groupings.

Conclusions

The people of Lake County might well carefully consider the recommendations of this study. The reorganization of school districts of Lake County into a single unified district will provide.

1. A unified administrative unit best suited to carry out the educational objectives of the public schools of California.
2. Secondary education equipped to meet the needs of young people from grades 7 through 12.
3. Elementary education that will stimulate and guide each individual in developing his abilities to their fullest extent for useful living.
4. Provide a sound tax base, and in doing so, equalize the burden of school support.
5. Provide a schematic plan for school district organization in Lake County that will serve as a guide for any future planning and study.

180 pages. \$2.35. Mic 57-2412

1. Policy of State Board of Education on School District Organization, Sacramento, California Schools. Publication of State Department of Education, 1956.

2. Ibid.

EDUCATION, HISTORY

THE EFFECT OF AMERICAN IDEAS UPON JAPANESE HIGHER EDUCATION

(Publication No. 21,563)

Hideo Aoki, Ph.D.
Stanford University, 1957

This study seeks to identify and analyze the effect of American ideas upon the structures, functions, and purposes of Japanese higher education. Special attention is given to the post-war educational reforms which were initiated and encouraged by the Occupation with the assistance of the United States Education Mission of 1946. Two earlier periods of American influences, the 1870's and 1920's, are appraised in terms of their relationship and significance to the historical development of Japanese higher education.

After a description of the problem in Chapter One, Chapter Two covers the pre-Meiji education (405 A.D.-1868). Before the Restoration of 1868 chiefly Chinese culture influenced Japanese education. Chapter Three traces Japanese education from the beginning of the Meiji period to the end of World War Two (1868-1945), showing that the reversal of the Tokugawa foreign exclusion policy in 1868 allowed western influence to flow freely into Japan.

Part Two traces the evolution of Japanese higher education from 701 A.D. to 1945. Chapter Four, opening Part Two, reviews the introduction of the Chinese unitary college and Chinese classics into the first Japanese university, thus determining their original structure and functions. Chapter Five shows how educational concepts introduced from the West between 1868 and 1918 shaped two important types of universities: (1) state-controlled Imperial universities patterned along the lines of the German university with its emphasis upon investigation and special education to train officials for the State, (2) private universities which emphasized the western concepts of freedom, individual development, and broadening of higher educational opportunities. Chapter Six describes the clash between liberalism and ultranationalism in higher education after World War One.

Chapter Seven goes back to 1868 and specifically identifies the American influences in Japanese higher education before 1945. As a result of American influences during the first decade of the Meiji period (1870-1880), Japanese education adopted the American single-track system. Democratic influences from the United States during World War One brought about the University Act of 1918, which officially recognized the private universities.

Chapters Eight and Nine take the analysis of American influence upon Japanese higher education into the post-war period. Seven major reforms in higher education were carried out by the American Occupation: (1) instituting the 6-3-3-4 system for Japanese education, (2) the structuring

of the three-year university into a four-year university, (3) the multiplication of universities, (4) the introduction of the junior college, (5) the official recognition of women's universities, (6) the introduction of a general education program in the universities, and (7) decentralized control of higher education. Chapter Nine reviews the influence of American-Japanese cultural exchange in the post-war period. Chapter Ten points out that the American Occupation reforms created two persisting problems in Japanese higher education, namely, the conflict between general education and special education, and the functional and structural status of the junior colleges. These problems are identified as part of the over-all conflict between American ideas and traditional Japanese concepts of the University adopted from Germany.

Chapter Eleven summarizes the facts and appraises the seven major post-war reforms in Japanese higher education. With the exception of the changes brought about by the reforms in higher education for women, these reforms generally show signs of impermanency and incompatibility in the Japanese higher educational system. Recent trends toward a reversion to the traditional German university structuring and functions and the centralized control of education are cited as evidences of the impermanency of American-imposed reforms. Earlier American influences in the 1870's and 1920's, voluntarily introduced and closely adapted to Japanese culture, survived two decades of ultranationalism and quickly reappeared after World War Two. The reforms of the Occupation, hastily imposed and transplanted uncritically from American culture, appear less likely to be permanently integrated into the Japanese educational system.

363 pages. \$4.65. Mic 57-2413

A HISTORY OF THE USE OF CERTAIN TYPES OF GRAPHICAL REPRESENTATION IN MATHEMATICS EDUCATION IN THE SECONDARY SCHOOLS OF THE UNITED STATES

(Publication No. 21,637)

Joseph Anthony Izzo, Ph.D.
Columbia University, 1957

Chairman: Myron F. Rosskopf

The amount of graphical representation found in mathematics textbooks published in the United States prior to 1900 and written for use in secondary schools was practically negligible. The one exception was trigonometry where graphs appeared in textbooks published at least as early as 1826.

Graphs seem to have made their first appearance in elementary algebra textbooks as a result of classroom experiments and beliefs of individual teachers that graphs could aid in the teaching and learning of mathematics. Probably the earliest elementary algebra textbook that contained graphs was published in 1883.

The increase in attention given to graphs in secondary school mathematics since 1900 has been tremendous. By 1903 the reform movement in mathematics education--spearheaded by Klein in Germany, Perry in England, and Moore in the United States--was well underway. Teachers in mathematics education were advocating, by 1903, that

the study of secondary school mathematics include practical uses of the subject. Statistics, variation, and the formula were practical topics for algebra, and the graph could be used to advantage with each of these. The graph could be used in everyday reading as well as in higher mathematics. The graph also suited modern learning theories.

Forces responsible for the reform in mathematics education in general and for the change in emphasis on graphical representation in particular, since about 1900, include: (1) a rapidly-growing school population with its increasing range of interests, abilities, and objectives; (2) advances in educational psychology; (3) improvement in the professional training of teachers; (4) requirements of the College Entrance Examination Board; and (5) work of various committees, commissions, and leaders in mathematics education. The reform movement led to curriculum changes, and many of these changes gave prominence to the graph.

In the algebra textbooks examined, graphs were used to introduce various topics in order to make certain principles clearer and more meaningful. Such topics included the graphic solution of simultaneous equations, the function concept, logarithms, and the graphic solution of quadratic equations.

Textbook writers used graphs to illustrate, among others, the topics of dependence, variation, interpolation, and roots of equations; the meaning of simultaneous, inconsistent, and dependent equations; the relationship between roots and coefficients of a quadratic equation in one unknown; statistics; imaginary and complex numbers; and trigonometric functions.

A total of 627 textbooks was examined. These included 361 algebra books, 17 books on integrated mathematics, 138 books on plane or plane and solid geometry, and 111 trigonometry books.

Findings include:

(1) Change in attention to graphical representation since 1900 was more evident in elementary algebra than in any other branch of secondary school mathematics. However, increase in attention was noted since 1900 in all branches considered.

(2) Elementary algebra textbooks published between 1904 and 1923 placed much emphasis on graphs, but authors differed as to whether the main emphasis should be in the first course or in the second course. The 1923 Report of the National Committee on Mathematical Requirements made the graph an essential part of the first course in algebra.

(3) First year algebra books published since 1923 have placed more importance on use of the graph as a learning device than had those published earlier.

(4) In several recently published plane geometry books the graph has been used in connection with locus problems and with analytic geometry.

Value of the graph as a learning device in mathematics is no longer doubted. Much has been done with the graph in teaching, more could and should be done. However, timing, imagination, and careful planning are essential for its effective use. 283 pages. \$3.65. Mic 57-2414

BENJAMIN FRANKLIN AS AN EDUCATOR

(Publication No. 21,525)

M. Roberta Warf Keiter, Ph.D.
University of Maryland, 1957

Supervisor: Professor Gladys A. Wiggin

This study describes the educational ideas of Benjamin Franklin, determines the effects of his activities on education, analyzes his philosophy of education, compares his educational proposals with contemporary and modern views and finally evaluates his contributions to and influence on education.

For purposes of this study, education is defined as the conscious and deliberate attempt through the acquisition and distribution of knowledge to adapt the individual to the culture and to provide for orderly directed cultural change in terms of the generally accepted social evaluation of new knowledge.

During his formative years, Franklin's Boston background, several journeys, and his sojourn in London made him cognizant of different cultural levels. His background and the intellectual climate of his era influenced Franklin to develop a concept of education which was purposeful in terms of self-realization and social needs.

Franklin, a true child of the Enlightenment, accepted the eighteenth century ideals which emphasized humanitarianism and rationalism. He believed in progress and the perfectibility of man but thought that the former depended upon the quest for new knowledge and its adaption to social needs, and that the latter was made possible through education.

Motivated by the ideals of service to mankind and self-realization, Franklin organized the Junto, through which civic projects and other agencies of education were initiated. Among these agencies the most significant were the subscription library which encouraged personal study and provided an example for similar institutions in other colonial towns; the American Philosophical Society which inspired the pursuit of knowledge and aroused interest in American scientific and humanistic achievements; and the Philadelphia Academy which was designed to implement Franklin's educational philosophy but which fell short of this goal.

Franklin's opposition to contemporary educational programs was founded on the belief that schools were too limited in their aims. Franklin thought that the traditional curriculum had ceased to serve the needs of the dynamic society which he envisioned and he designed his curricular proposals to rectify the inadequacies of the traditional program. He intended his curriculum to serve individual and community needs by encouraging the pursuit of knowledge and its application to social problems.

Franklin made his printing a vehicle for service to mankind. He recognized the various avenues which were open to the printer for imparting knowledge, and intended all his publications to instruct or to entertain. He trained printers and assisted them in establishing newspapers in other colonies. Franklin stimulated the growth of colonial newspapers which were instrumental in establishing common purposes and uniting Americans to pursue their common destiny.

Through his scientific discoveries and his pertinent observations on political, social and moral questions,

Franklin made contributions to knowledge and inspired additional research and experimentation. His vast achievements as scientist and political leader gave Franklin an international reputation which was a significant factor in his successful endeavor to promote and advance education.

284 pages. \$3.65. Mic 57-2415

EDUCATION, PHYSICAL

PERCEPTIONS OF PHYSICAL EDUCATION: PERCEPTIONS OF THE PURPOSES OF A PHYSICAL EDUCATION PROGRAM IN A SELECTED SECONDARY SCHOOL

(Publication No. 21,560)

Marguerite Ann Clifton, Ed.D.
Stanford University, 1957

Purposes of the study.— The purpose of this study was to examine the relationship between the perceptions of physical education in general that one may have, and his perceptions of the purposes of a selected physical education program. The collection of data was directed toward answering the following questions:

1. What is the extent of agreement in the perceptions of what should be the purposes of physical education among and within the following groups: senior students enrolled in physical education, parents of these students, teachers of physical education, and teachers of other subjects?
2. Is there any relationship between an individual's perceptions of what the purposes should be and the accuracy of his perceptions of what the purposes are in a particular school?
3. Are there identifiable socio-economic differences among perceptions of the parents?
4. What is the relationship of parents' general attitudes toward physical education and the accuracy of their perceptions of the actual purposes of a selected program?

Summary of procedures.— Sequoia High School, Redwood City, California was selected as the site of the study. Six groups associated with this school were to participate in the study. These included all senior male students and senior female students enrolled in physical education, their parents, the boys' physical education faculty, the girls' physical education faculty, and all other faculty of the school.

A pilot study was conducted for the purpose of suggesting perceptions of the purposes of physical education and to minimize the danger of overlooking perceptions that might be held by the population sampled. One hundred and sixty-seven participants, selected by random sample technique from the population, made free response to the incomplete sentence, "The purposes of physical education are:."

Two checklists were constructed for use in collecting the data. Each checklist had nineteen statements of pur-

poses of physical education which were evolved from pilot study statements, the literature, and the Sequoia High School program. Statements were identical and arranged in the same order for both checklists. The six response categories on Checklist One permitted the respondents to indicate the degree to which each statement of purpose should be included in the physical education program. The five response categories on Checklist Two permitted respondents to indicate the degree to which each statement was a purpose of the Sequoia High School physical education program. An interval of one month separated the administration of both checklists, and only those respondents completing Checklist One were given the second checklist. Fifty-five percent of the population completed both checklists.

The Fisher t-test was used for determining significance of differences between means of groups. An accuracy-of-perception score derived from the physical education faculty responses was used to find the accuracy with which the various groups perceived the purposes of the Sequoia program. Attitude toward the physical education program was determined by summing the differences between item responses on both checklists, and finding the relationship between these two measures by means of the Pearson product-moment coefficient of correlation.

CONCLUSIONS

1. The extent of agreement in the perceptions of what should be the purposes of physical education among and within the six groups was as follows:
 - (1) all groups agreed upon seven purposes to be included in a physical education program:
 1. To improve physical fitness (muscular development, physical endurance, and coordination.)
 2. To develop a variety of interests by participating in all the available activities.
 3. To be taught the fundamental skills needed for effective participation in physical activity.
 4. To learn to enjoy physical exercise.
 5. To learn how to work well with a group: teamwork.
 6. To develop a spirit of fair play and sportsmanship.
 7. To insure adequate care of self in deep water.
 - (2) all groups agreed it should not be a purpose "to learn the attitude that the essential thing in competitive sports is winning"; (3) all groups expressed undecided opinion about the proposed purpose "to receive correction for physical defects such as a lateral spinal curvature"; and (4) varied opinions were expressed by all groups about the following purposes:
 1. To acquire specific health habits like cleanliness and relaxation.
 2. To improve skill in activities in order to become a varsity team player.
 3. To enable varsity team players to gain further practice in their specialty.
 4. To become skilled in activities for use during leisure time.

5. To get rid of excess energy.
6. To become better acquainted with classmates.
7. To learn the rules and strategies of the sports.
8. To learn to enjoy boy-girl participation in individual and dual sports (archery, golf, tennis, and badminton.)
9. To learn to enjoy boy-girl participation in the team sports of volleyball and softball.
10. To learn to enjoy boy-girl participation in folk, square, and social dance.
2. In this study, there is little or no relationship between an individual's perceptions of what the purposes of physical education should be and the accuracy of his perceptions of what the purposes are in a selected secondary school physical education program.
3. In general, parents representing various occupational groups possess similar perceptions of physical education.
4. No significant difference was found among the socio-economic groups with respect to their correct perceptions of the purposes of the selected program.
5. In this study, only a low positive correlation was found between the parents' general attitudes toward physical education and the accuracy of their perceptions of the actual purposes. Consequently, it cannot be predicted that individuals with good attitude will have accuracy of perceptions.
- 141 pages. \$2.00. Mic 57-2416

A STUDY OF THE HISTORICAL DEVELOPMENT OF PHYSICAL EDUCATION IN ENGLISH SCHOOLS TO 1945 (VOLUMES I AND II)

(Publication No. 21,411)

George Augustus Knaggs, Ed.D.
University of Houston, 1957

The study traces the historical development of physical education in English schools to 1945 and the historical development of each physical education activity employed in the schools of England. Various factors which contributed to the formation of the English program of physical education are also discussed, and an account presented of English education pertinent to the development of physical education.

The political, economic, and social history of England, and in particular, parliamentary acts, were considered in their relationship to the education of the masses. Data were collected and evaluated in England during the academic years 1952-1953 and 1954-1955. This data included interviews in English elementary and secondary schools, universities, and gymnastic colleges, as well as that gathered from primary and secondary sources in libraries of government ministries, of the University of London, the British Museum, and of gymnastic training colleges.

The evidence indicates that prior to the twentieth century, two programs of physical education developed in English schools. The traditional English games and sports

developed in private boarding schools catering to the upper classes, without the sanction of the administration of the schools. Military drill, calisthenics, and Swedish therapeutic exercises developed in government-aided elementary schools for the lower classes. After the turn of the century military drill lost its educational prestige as a disciplinary measure in elementary schools and was replaced by the Swedish system of physical exercises, while games and sports continued as the program of physical education in the private schools. During the 1920's swimming, dancing, and the traditional games and sports of the private schools gradually took equal rank with physical exercises in government-aided and state schools, and in the 1930's became a formally recognized part of the program. In private schools the traditional games and sports still predominated. In 1939, as national efforts were turned toward war, expansion of physical education was halted, and revision of the physical education curriculum was postponed until the end of the war in 1945.

Each of the foregoing developments has been described in detail and documented in the study.

596 pages. \$7.55. Mic 57-2417

AN ANALYSIS OF MEASUREMENTS OF ORGANIC EFFICIENCY OF BOYS

(Publication No. 20,882)

William Andrew Robert Orban, Ph.D.
University of Illinois, 1957

PURPOSE To determine: (1) the stability (reliability) of the measurements of organic efficiency; (2) the standard errors of measurement for each of the variables; (3) the relationship of the various measurements to each other, as well as their relationship to the trained and untrained state; and (5) the effect of variation within an individual and the differences between individuals in the assessment of progressive changes and present status of fitness of young boys.

METHOD Two fundamental methods were employed in this study: one was the statistical analysis of the measurements (heart rates, blood pressures in the quiet resting states as well as after various intervals after exercises of different intensities; various deflections of the electrocardiogram; tracing from the heartogram; vital capacity; times of a 60-yard dash and 440-yard run) of a group of 32 boys 7-13 years of age who were tested on four successive days; the second, the experimental aspect of the study involved 7 boys (11-16 years of age) and one mature college athlete (21 years old) who were tested before and after a season of competitive speed skating. (The measurements used included those used in the group statistical analysis as well as oxygen intake before, during and after an exhaustive run.) In addition, one of the younger speed skaters (a prepubescent boy), who was of National Championship caliber, was tested at 3-week intervals throughout and following a complete competitive skating season.

RESULTS 1. Stability of Measurements: Although the majority of the measurements analyzed in this study have significantly high reliability coefficients, only those which

had a .75 coefficient or greater can be accepted as sufficiently stable. These were as follows: the lying and standing blood pressures; the lying and sitting heart rates; the total recuperation count after the 5-minute step test, which was the most stable; the systolic amplitude of the brachial pulse wave from the heartogram; the S-wave of the electrocardiogram; the total of the 2-minute heart rates taken after the different levels of exercise; and the oxygen intake measurements in the quiet state, and during sub-maximal and maximal exercise. The standard error of all measurements are listed in Table 1.

2. The Interrelationships of the Measurements: 1) the resting heart measurements are related to all the heart rate counts which are taken after different intensities of exercise. However, this relationship decreases as the intensity of the exercise increases; 2) the height of the T-wave is related to those activities which require some degree of endurance; the higher the T-wave the better the time of the 440-yard run as well as the number of hops a boy can perform, and the higher the T-wave the less the heart rate will increase after all moderate levels of exercise.

3. Relationship of Measurement to Training: The trend line plotted for one individual through a training and de-training period, because it varied in a systematic manner, displays a significant relationship of certain measurements to the level of fitness (period of training and de-training). It appears that the organic capacity of this boy as measured by the maximal oxygen intake during an all-out TMR at 7 mph is very closely related to the state of training that he is in. His organic efficiency, as measured by his oxygen intake at rest and the cardio-vascular indices, improves with training. The indices that showed improvements were as follows: the Tigerstedt Index; the Stone Index; and the Erlanger-Hooker Index.

4. Each individual boy is affected by training in a unique way, both in manner and degree. Along with this there is a variation of the same measurement within an individual boy, under the same condition, from day to day. Therefore, if one is to appraise any progressive changes with any degree of accuracy which is attributable to training, each boy must be tested, before, at regular intervals during, and after the training period.

202 pages. \$2.65. Mic 57-2418

their counseling interviews. Communication in counseling was defined as that interaction between counselor and client in the counseling relationship which aids the client in discussing the affective and/or cognitive material which is related in a pertinent manner to his problem.

The measures used to identify personal characteristics were the Strong Vocational Interest Blank Psychologist scale and six of the Social Service Scales, the Miller Analogies Test, the Minnesota Multiphasic Personality Inventory, the Berkeley Questionnaire, the Bills Index of Adjustment and Values, the Taylor Manifest Anxiety Scale, and the number of graduate hours in the general area of counseling psychology. A communication rating scale, as rated by judges who supervised the trainees in a counseling practicum course, was the criterion measure of effective communication. Twenty-seven trainees, 22 male and 5 female, were used as subjects in this study while they were enrolled in the counseling practicum course at the University of Missouri.

The following null hypotheses were tested with correlation techniques:

1. No relationship exists between SVIB Psychologist scale scores and the criterion.
2. No relationship exists between six social service scales found on the men's form of the SVIB and the criterion.
3. No relationship exists between Miller Analogies Test scores and the criterion.
4. No relationship exists between MMPI validity and clinical scales and the criterion.
5. No relationship exists between manifest anxiety as measured by the Taylor MAS and the criterion.
6. No relationship exists between adjustment as measured by the Bills Index of Adjustment and Values and the criterion.
7. No relationship exists between tolerance for ambiguity as measured by the Berkeley Questionnaire and the criterion.
8. No relationship exists between number of graduate hours in the general area of counseling psychology and the criterion.

Hypotheses 1, 2, 3, 4, 5, 6, and 8 were supported by the results of the study, since the null hypothesis could not be rejected at the .05 level of confidence. The results did not support hypothesis 7; instead, it was indicated that a positive relationship exists between tolerance for ambiguity and effective communication in counseling.

The following conclusion is based on the limited range of scores obtained on each test variable. If a wider range of scores had been found, then it is possible that significant relationships would have been discovered to exist. The results support the conclusion that effective communication in counseling for practicum trainees, at their stage of development, is not dependent upon any of the following variables:

1. Interest in psychology and/or social service fields of work as measured by the SVIB.
2. Verbal ability as measured by the Miller Analogies Test.
3. Personality traits as measured by the MMPI.
4. Manifest anxiety as measured by the Taylor MAS.
5. Behavioral adjustment as measured by the Bills Index of Adjustment and Values.
6. Number of graduate hours in the general area of counseling psychology.

EDUCATION, PSYCHOLOGY

THE RELATIONSHIP BETWEEN PERSONAL CHARACTERISTICS OF COUNSELING TRAINEES AND EFFECTIVE COMMUNICATION IN COUNSELING

(Publication No. 21,098)

Jerome Martin Brams, Ph.D.
University of Missouri, 1957

Supervisor: Robert Callis

The purpose of this study was to investigate the relationship between some personal characteristics of counseling trainees and the effectiveness of communication in

The results do suggest that effective communication in counseling is related to the counseling trainee's degree of tolerance for ambiguity, as measured by the Berkeley Questionnaire. Intolerance for ambiguity appears to be associated with less effective communication, while tolerance for ambiguity appears to be associated with more effective communication. 122 pages. \$2.00. Mic 57-2419

AN EXPLORATORY STUDY OF PIANO PLAYING BEHAVIOR IN TWO GROUPS OF CHILDREN

(Publication No. 20,412)

Arthur Mark Kaplan, Ph.D.
Cornell University, 1956

This study set out to record and analyze piano playing behavior in talented and untalented children. Eight children ranging in age from ten years and eight months to fourteen years and one month comprised the total group studied. A music teacher's ranking and a judges' evaluation determined in which of the two groups a child would be placed.

The talented group was given three musical selections containing ten measures while the untalented group received three other selections containing eight measures. Each child was given five trials to learn the given selection and the first, third, and fifth trials were recorded on a disc recorder. Selections were chosen so as to be appropriate for each ability group.

The analysis of data included an error count as well as visual observations of each child's performance. A measure for measure analysis was carried out for each recorded trial. The original score was placed on staffed paper and the child's performance placed directly beneath the original one. A system of notation was devised to aid the analysis.

The error analysis focused on four kinds of difficulties: accidental notes, leger-line notes, signature notes, and note values. In addition, pauses, omissions, and corrections were analyzed. Visual observations provided information regarding the child's approach to the task, frustration tolerance, verbalizations, etc.

It was hoped that a dimension of difficulty might be included so that one could study the manner in which children learn to play simple, average, and difficult selections. The analyses indicated that the simple and average selections were not clearly differentiated. All of the data were thus combined. Furthermore, specific comparisons could not be made between groups since each group received different selections. It was possible to make general comparisons between the groups and to compare the behavior within each group.

The findings indicate that both groups had the least amount of difficulty with leger-line notes, little difficulty with accidental notes and the observation of note values, but somewhat greater difficulty with signature notes. Pauses and omissions occurred more frequently in the untalented group while the talented group corrected more errors. These findings indicate that children utilize available cues and so had little difficulty with leger-line notes and accidentals. They do not seem to approach the learning of a selection in terms of a configuration such as key but rather depend on memorization of the signature reading.

There was an almost unanimous need to re-group irregular rhythm patterns so that they could be played in a regular manner. This seemed to make a better gestalt. In view of the distribution of pauses, omissions, and corrections, it appears that the talented group play with greater spontaneity, are more thorough, and stress accuracy to a greater extent than does the untalented group. Both groups decreased their number of errors with each practice trial and the greatest increment in learning occurred within the first three trials.

Differences were evident when the children were compared with one another within each group. When the analysis and visual observations were related to the general personality features gleaned for each child, it was found that a child plays the piano in a manner which is consistent with his style of life. Thus, the hostile and aggressive child plays the piano differently than the timid and retiring child. No two children can play the piano in the same manner. The child is limited by what he is.

One can conclude that it is possible and fruitful to record and analyze piano playing behavior in children. This area has been heretofore unexplored and offers many opportunities for future research.

152 pages. \$2.00. Mic 57-2420

PITCH OF THE VOICE IN CERTAIN SPEAKING AND READING ACTIVITIES AMONG ELEMENTARY SCHOOL CHILDREN

(Publication No. 19,671)

Helen Frances Kyle, Ed.D.
Boston University School of Education, 1956

Problem:

To provide from objective pitch measurements, an answer to the question: What does a child do with his vocal pitch in certain speaking and oral reading activities?

Scope and limitations of the study:

1. Voice samples were obtained from 93 boys and 67 girls in grades two, four, and six from eight classrooms in two schools in a city near Boston, Massachusetts.
2. Oral activities studied for mean vocal pitch characteristics were: (1) speaking, (2) easy reading, (3) unaided recall of easy reading, (4) difficult reading, and (5) unaided recall of difficult reading.
3. Purdue pitch meter was used to count the fundamental frequencies (cps) of the sound waves of each voice.
4. California Short-Form Test of Mental Maturity and the Metropolitan Achievement Test were given to the population so comparisons could be made of the relationship of vocal pitch to intelligence and educational achievement.

Procedure:

Voice samples of the five oral activities being studied were tape-recorded. These were processed by the Purdue pitch meter, which detected, counted, and recorded the fundamental frequencies of each sample. Reliability of the pitch record and methods for scoring it were determined.

The data were grouped and regrouped according to grade, sex, intelligence, and educational achievement for statistical analysis. Comparisons were made to reveal significant differences between the mean pitches used in each of the five oral activities within grades two, four, and six, as well as between these grade levels. It should be noted that the statistically significant differences in mean pitch reported below are less than a semitone in extent and might be very difficult to detect by listening.

Major findings and conclusions:

1. Grade two speaking pitch is significantly higher than grade six speaking pitch.
2. Easy and difficult reading pitches are significantly higher than the speaking pitches at grades two, four, and six.
3. Easy and difficult recall pitches are significantly higher than the speaking pitch at grade six.
4. Mean pitches in unaided recall of easy and difficult reading are significantly lower than easy and difficult reading pitches at grades two, four, and six.
5. Within grades two, four, and six there is significant raising of mean pitch from unaided recall of easy reading to difficult reading.
6. Fourth-grade boys use a significantly higher unaided recall of easy reading pitch than girls in the same grade.
7. Second-grade girls use a significantly higher speaking pitch than sixth-grade girls.
8. The lower achievement groups at grades two and four use significantly higher mean pitches in speaking than the upper achievement groups.
9. No significant differences are found in boys' vocal pitches between grades two, four, and six.
10. No significant differences are found within grades two, four, and six in mean vocal pitches used by pupils of low and high intelligence.

Criticisms and suggestions for further study:

1. Any regional influence on pitch might have been diminished by selecting the population from a larger number of schools in many localities.
2. A study of causative factors influencing raising and lowering of vocal pitch would add much to the present information about children's use of pitch.
3. A study might be made to disclose vocal pitch in oral activities other than those used in this study.
4. A study might be conducted to find the relationship of the teacher's vocal pitch to that of the pupils.

179 pages. \$2.35. Mic 57-2421

**SOME FACTORS RELATED TO WORK ATTITUDES
IN NINTH GRADE BOYS**

(Publication No. 21,625)

Malavalli Yoganarasimhiah, Ph.D.
Columbia University, 1957

Chairman: Donald E. Super

A proper recognition of the influences of various relevant factors is essential before we can guide or change an individual's work-attitudes, in the interest of individual happiness and social progress. Relatively little is known about the factors that influence the development of work-attitudes, although socio-economic factors and family patterns have been found to be important in other studies. The present study was designed to determine the relationship of some relevant factors to work-attitudes in adolescence, the period during which work-attitudes probably become crystallized. The work-attitudes of a group of ninth-grade boys, ranging in age from thirteen to eighteen, with a mean of fifteen, were measured and correlated with such factors as age, intelligence, general adjustment, level of vocational preferences, socio-economic status of family and rural-urban background.

This study was undertaken with the data from the Career Pattern Study at the Horace Mann-Lincoln Institute of School Experimentation. One hundred of the total of 143 ninth-grade boys, those for whom all needed data were available, were used as subjects in the present investigation. Data concerning the boys included psychological test results and verbatim transcripts of the interviews. These transcripts contained data concerning the boys' work-attitudes. Data regarding the other correlated variables were obtained from tests and questionnaires.

Three scoring scales were developed in order to appraise the work-attitudes that these ninth-grade boys had expressed during the semi-structured interviews. Interview protocols were analyzed to locate statements bearing on work-attitudes and scoring was based on these statements. Each boy was scored on the three scales. Scores on the three scales were intercorrelated and the scales were found to be moderately or only slightly correlated with each other. This was as expected, in view of the fact that all the three scales were designed to assess work-attitudes, which it would be logical to find related but relatively discrete. Consequently the other variables under consideration in this study were separately correlated with each of these scales.

The boys' work-attitude scores on each scale were separately correlated with each of the six variables, namely, age, intelligence, general adjustment, level of vocational preferences, socio-economic status and rural-urban background. In all, eighteen hypotheses were formulated to test the significance of the relationships. Seventeen of these hypotheses were tested by the method of correlation and one hypothesis was tested by the χ^2 method. Contaminating factors were partialled out by statistical methods in computing the correlations.

None of the seventeen correlations was very high and only three were significant. These were positive correlations between intelligence and liking for work; between level of vocational preferences and emphasis on intrinsic rewards; and between the socio-economic status of the family and the extent of discussion of the rewards of work.

Some other variables were related to work-attitudes to a degree that approached significance. Perhaps these relationships would prove significant in an older group of boys.

56 pages. \$2.00. Mic 57-2422

EDUCATION, TEACHER TRAINING

AN EXPERIMENT WITH CLOSED-CIRCUIT TELEVISED INSTRUCTION IN TEACHER EDUCATION

(Publication No. 20,904)

Yvonne Marie Sheriff Lofthouse, Ed.D.
Wayne State University, 1957

Adviser: Charlotte Junge

During the spring semester of 1956 an experiment was conducted at Wayne State University involving the teaching of a College of Education course, namely "Methods and Materials of the Language Arts," by means of closed-circuit television. The purposes of this pilot study were to identify the problems and procedures involved in producing a telecourse, to determine the attitudes of students toward televised instruction and to compare the learning of students through televised instruction with learning through presentations made directly in the classroom.

Two equivalent groups, each composed of twenty-eight regular, four-year, undergraduate education students, matched in pairs on the basis of honor point average, A.C.E. scores, sex, curriculum, and student teaching contact, were involved in the experiment. Each group received one-half semester of televised instruction plus one-half semester of instruction presented directly in the classroom. With the exception of the type of instruction, all other factors such as the instructor, the methods and materials presented, and the topics for the 20-minute discussion period which followed each half-hour presentation, were held constant. In addition, by reversing the type of instruction at midsemester, the experiment was replicated. The data included records kept by the instructor, answers on questionnaires, and scores on a modified, essay-type examination administered on the first class day, half of which was readministered at midsemester and the other half of which was readministered at the end of the semester. The chief statistical procedures employed were the chi-square, the rank correlation coefficient, and the "t" test of significance.

Conclusions

The data presented in this study indicate that:

1. Courses in professional education can be satisfactorily taught by television and that students achieve equally well in classroom and/or television courses; there is no significant difference between learning in the television situation and learning when the material is presented directly in the classroom by the same instructor. Furthermore, there is no significant difference in total learning whether televised instruction follows or precedes classroom instruction.

2. Television teaching consumes more of the instructor's time and effort than conventional teaching and at least four sections of a course would have to be taught simultaneously to accomplish any saving of the instructor's time unless assistance was provided.

3. There is no difference in student attitude toward a course generally whether it is presented by television or directly in the classroom; students tend to like and dislike the same aspects of a course in each situation, except that televiewing students are additionally critical of deficiencies in transmission of the television presentations. Opinion is equally divided on whether televised instruction holds attention better than conventional instruction.

4. Students prefer classroom instruction to televised instruction when the instructor and methods are held constant.

5. Seventy-five per cent of the students state they miss the opportunity to participate in discussion during a half-hour presentation period and students believe a discussion period following a television class to be valuable.

6. Instructional procedures considered by students to be effective when presented directly in the classroom are equally effective over television but instructional materials are considered less effective when presented over television than they are in the classroom. There is very little relationship between the way materials are ranked for effectiveness in the two situations.

7. Conventional classrooms require adaptation to be appropriate for televiewing, particularly in regard to seating, darkening of the room, and provision of light for note-taking.

236 pages. \$3.05. Mic 57-2423

COMPARISON OF TEACHER EDUCATION STUDENTS WHO INDICATED DIFFERENCES IN ACCEPTANCE OF TEACHING AS A VOCATIONAL OBJECTIVE

(Publication No. 21,538)

William Christian VanNewkirk, Ed.D.
University of Maryland, 1957

Supervisor: Professor Richard H. Byrne

A study of eighty-seven teacher education freshmen who showed differences in their acceptance of teaching as a vocational objective was made at a state teachers college which prepares its graduates for elementary and junior high school teaching and which includes a junior college program for students who plan to transfer to four year institutions. There were also fifty-eight junior college students for a control group and eighty-one seniors for a criterion group. A preliminary study showed that as a first reason only about 15 percent of the students selected it for its low cost, 28 percent for its nearness to home, and 8 percent for other reasons; and 40 percent of the freshmen would prefer an occupation other than teaching. On the basis of a theory of occupational choice it was assumed that the difference in attitude toward teaching arose from differences in the pattern of abilities, interests, and personality traits, and four hypotheses postulated on this assumption were:

1. The teacher education freshmen who are definite about teaching are significantly different from the teacher

education freshmen who are indefinite about their vocational objective.

2. The teacher education freshmen who are definite about teaching are significantly different from the junior college freshmen who in turn are not significantly different from the teacher education freshmen who are indefinite about teaching.

3. The seniors constitute a relatively homogeneous group in terms of measurable, psychological traits.

4. The teacher education freshmen who are definite about teaching are significantly like the seniors, but the teacher education freshmen who are indefinite about teaching are significantly different from the seniors.

Measures of ability were: the A.C.E., the Cooperative English Test, and the Cooperative Achievement Tests; of interests were: the Cooperative Contemporary Affairs Test and the Michigan Vocabulary Profile Test; and of personality were: the Gordon Personal Profile and the Minnesota Teacher Attitude Inventory. Comparisons for significant differences of the teacher education freshmen's mean scores were made with each other, with the control group - junior college students, and with criteria groups - senior students on all tests except the Contemporary Affairs, and experienced teachers on the Vocabulary and Gordon instruments. An inspectional analysis was also made of the total profile for the Gordon, and the Vocabulary profile was also analysed by testing for the significance of the difference between the rank difference correlation coefficients, the ranks being based on the average scores for each division and the total. There were thirty-two comparisons between the freshmen groups and twenty-eight between the freshmen and the seniors. Men and women were compared separately and combined, and the 5 percent level of confidence was adopted as the standard for significance. The small number of differences which met this standard could have occurred by chance and hence, hypothesis 3 was supported, but hypotheses 1, 2, and 4 were refuted.

200 pages. \$2.60. Mic 57-2424

EDUCATION, THEORY AND PRACTICE

THE RELATIONSHIPS AMONG MEASURABLE MENTAL TASKS RELATED TO READING

(Publication No. 18,759)

John Richard Chambers, Jr., Ed.D.
Boston University School of Education, 1956

Problem

The purpose of this study was: (1) to study the relationships existing among certain selected higher mental processes related to reading; and (2) to study the relationships of these higher mental processes to reading achievement, intelligence, mental imagery, and chronological age.

Procedures

The procedures used in this study revolved around the following main objectives: (1) the identification of higher mental processes through a review of related research

(Elaborative Thinking, Critical Thinking, Organizational Thinking); (2) the construction of a test of Organizational Thinking; (3) the levels of achievement attained on tests of the selected higher mental processes, reading achievement, intelligence, and mental imagery; and (4) the determination of the interrelationships among the higher mental processes and their relationships to reading achievement, intelligence, mental imagery, and chronological age.

The entire fourth, fifth, and sixth grade enrollments of two suburban Massachusetts communities made up the population used in the study. These 459 children were administered the following battery of seven tests: California Short-Form Test of Mental Maturity (Elementary); Gates Reading Survey for Grade 3 (2nd Half) to Grade 10; Test of Critical Thinking in the Social Studies, by J. Wayne Wrightstone; a Test of Organizational Thinking, constructed by the writer; and the following instruments developed at Boston University: Associational Reading Skills (Elaborative Thinking), Fact and Opinion Statements (Critical Thinking), and Mental Imagery Checklist.

Conclusions

1. Children at each successive grade level tend to evidence increasing amounts of ability on tests of higher mental processes, reading achievement, and intelligence. However, these differences in achievement are not statistically significant in all areas.
2. Ability in one area of higher mental processes does not appear to indicate a corresponding amount of skill in each of the other areas. Skill in Elaborative Thinking bears the least consistent relationship to the other higher mental processes ($r = .337$ to $.556$), while ability in Critical Thinking in the distinguishing of fact and opinion statements bears the greatest consistent relationship ($r = .337$ to $.711$).
3. Intelligence bears a positive relationship to higher mental processes ($r = .403$ to $.779$ with the mean of the coefficients being $.564$). Elaborative Thinking evidences the least, and Critical Thinking the greatest, relationship to intelligence.
4. Except for its relationship to Elaborative Thinking at the fourth and fifth grade levels, reading ability bears a substantial relationship to higher mental processes ($r = .302$ to $.765$ with the mean of the coefficients being $.646$). Reading comprehension appears to influence the degree of relationship more strongly than either vocabulary or speed of reading. Elaborative Thinking bears the least, and Critical Thinking the greatest, relationship to reading ability.
5. Mental imagery bears very little relationship to the higher mental processes ($r = .036$ to $.422$). Critical Thinking evidences the highest consistent relationship to mental imagery.
6. When computed on single grade populations, chronological age relates negatively to higher mental processes ($r = -.011$ to $-.397$). However, when this relationship is studied over a three-grade population, a positive relationship is evidenced ($r = .059$ to $.266$).
7. Except for the relationship among reading abilities, when factors of intelligence are held constant the resulting correlations among higher mental processes,

- reading achievement, and mental imagery are substantially lowered ($r = .001$ to $.918$). Critical Thinking persists in bearing the highest correlation to the other higher mental processes, and Elaborative Thinking the least relationship.
8. Except for the relationships among intelligence factors, when total reading is held constant the resulting correlations among higher mental processes, intelligence, and mental imagery are substantially lowered ($r = -.002$ to $.792$). Critical Thinking again relates more highly to the other higher mental processes.
9. Sex differences in achievement on all tests appear to be evident, although the differences are only occasionally significant.
10. The reliability of the original Test of Organizational Thinking was determined by use of the Kuder-Richardson Formula #21 as being .957.
- 198 pages. \$2.60. Mic 57-2425

A STUDY OF VOCABULARY SIZE OF THIRD GRADE PUPILS IN RELATION TO HOME-ENVIRONMENTAL FACTORS

(Publication No. 19,269)

Martha Eaton Dawson, Ed.D.
Indiana University, 1956

Chairman: Leo C. Fay

Problem. The purpose of this investigation was to determine first, the vocabulary level of a select group of third grade pupils and second, to determine whether significant differences existed between vocabulary and home-environmental factors.

Procedures. The Seashore-Eckerson English Recognition Vocabulary Test, Form 1, Part 1, was used to obtain an estimation of the basic vocabulary size of 131 pupils, from lower socio-economic homes in Richmond, Virginia, and 69 of their mothers. A questionnaire was used to secure information on the formal education and occupations of the mothers of all the pupils used in the study. A check list was used to interview pupils on their home-environmental experiences.

Statistical techniques. The t test at the 1 per cent confidence level was used to test the null hypothesis that:

1. There was no significant difference between the vocabulary level of the mothers and pupils.
2. There was no significant difference between the vocabulary of the pupils who ranked in the upper quarter on the Home-Environmental Check List and the pupils who ranked in the lower quarter.

Pearson's correlation coefficient was used to determine the relationship between the vocabulary of the pupils and the education of their mothers. The significance of r was tested at the 1 per cent confidence level.

CONCLUSIONS

1. The sample population used in establishing the norms for the Seashore-Eckerson English Recognition

Vocabulary Test was not typical of the American public elementary schools. The subjects seemed primarily to be representative of the upper-middle and middle-class socio-economic levels.

2. The vocabulary size of pupils from lower socio-economic homes is comparatively low at the third grade level. Is it possible that, at this level, the home-environment exerts the greater influence on the language patterns of the children than does the school environment?

3. Within a low status socio-economic group one finds a wide range of language skills and abilities. Although many pupils within the group tend to be somewhat limited in their skills, some others will possibly possess average and above average skills.

4. While the mothers are superior to their children in understanding vocabulary, 30 per cent made vocabulary scores within the pupils' range. The mothers' scores were lower than many third grade pupils of other socio-economic groups.

5. The educational attainment of the mother is possibly a positive factor that contributes to an individual's language pattern. However, more research is needed before a definite conclusion can be reached.

6. Since the pupils with more favorable home-environmental experiences had larger vocabularies it is likely that such boys and girls would have greater possibilities for success in the language arts curriculum than those with meager home-environmental experiences.

7. It would seem that even with the controlled vocabulary of curriculum materials, children with meager home-environmental experiences would tend to experience difficulty in extracting meaning from the printed page.

8. Primary pupils entering the middle grades with limited vocabularies and meager home-environmental experiences will be handicapped unless the school takes some measure to eliminate the handicap.

72 pages. \$2.00. Mic 57-2426

A SURVEY OF THE PRESENTATION OF CERTAIN TOPICS IN TEN SERIES OF ARITHMETIC TEXTBOOKS

(Publication No. 21,531)

Carl Mauro, Ed.D.
University of Maryland, 1957

Supervisor: Doctor Alvin W. Schindler

Arithmetic textbooks are prepared by specialists who have given much thought to problems of gradation, sequence, and method. Unfortunately, teachers do not always have an opportunity or an inclination to become fully acquainted with the textbooks they use. They may use teaching aids without comprehending basic strategies on which they are based. They may dutifully teach skills developed in a book and not be fully cognizant of the sequence in which the skills are introduced. They may not perceive how the program for a given grade fits into the total arithmetic program. Because of this lack of insight, teachers fail to realize all the potential values which textbooks offer. Recognition of this loss prompted the writer to assemble data which would enable teachers to better understand arithmetic programs provided by textbooks.

The Purposes and Scope of the Study

This study was undertaken to compile and organize information on the presentation of certain operational skills in arithmetic textbooks to the end that teachers and supervisors might use the books more effectively. To accomplish this general purpose, the writer undertook an analysis of ten series of arithmetic textbooks to determine (1) the grade placement of the initial introduction of certain basic skills, (2) their sequence of presentation, and (3) the developmental techniques used to introduce them. The analysis of the textbooks was limited to six large areas of operational skills; namely, multiplication and division of whole numbers, common fractions, and decimal fractions.

Procedures Used in This Study

The writer surveyed the literature for theory and related historical facts on grade placement and sequence. Six areas of operational skills were identified. Textbooks on teaching arithmetic were consulted for principles and techniques relevant to teaching these areas. Classifications of subskills for each area were also identified. Certain limitations were made in keeping with the purposes of the study. Thus, there are identified twenty-three subskills in multiplication of whole numbers, twenty-eight in division of whole numbers, eight each in multiplication and division of common fractions, and nine each in multiplication and division of decimal fractions. Tables were designed and criteria established for identifying data on them. The children's textbooks were then analyzed to determine grade placement and sequence of the initial introduction of each subskill. These data were sent to the senior authors of the ten series analyzed, for their confirmation. Again the textbooks were analyzed to identify the basic techniques employed in the introduction of each subskill in each series. A trial chapter was written to test the tentative organization.

Major Findings

The data show considerable agreement in grade placement, sequence, and techniques of presentation of the subskills in the six areas analyzed. Several subskills show grade-placement differences of one or two years among certain series. Topics are spread over several grades rather than "mastered" in one.

There is less agreement in the area of sequence than in grade-placement data. Occasionally, a skill is introduced first as well as last in different series; or, a skill may be introduced first or second in most series and yet not be introduced at all in another. Certain subskills are introduced in a different sequence-position in each series. Also, a skill may be introduced in a similar sequence-position in two series but in one of them it is introduced a year later.

Some authors rely more than others on the ability of pupils to generalize their understandings and to transfer them to any types of problems. Therefore, the former introduce fewer subskills than the latter.

On the whole, the greatest amount of difference seems to be in the methods of introducing the new subskills by the various series. Most controversial issues are found in this area. Generally, current practice espouses the meaningful, developmental approach in arithmetic instruction. However, it seems that the professional literature emphasizes objectified teaching more than is found in actual practice.

337 pages. \$4.35. Mic 57-2427

A DESCRIPTIVE ANALYSIS OF A DEPARTMENTAL CURRICULUM IMPROVEMENT PROJECT IN AN URBAN JUNIOR HIGH SCHOOL

(Publication No. 20,907)

William M. Rasschaert, Ed.D.
Wayne State University, 1957

Adviser: J. W. Menge

The problem of this study was to analyze and describe what happened when a teacher-administrator group initiated, organized, conducted and evaluated a curriculum improvement project in one department of an urban junior high school over a period of two, full semesters. Two major assumptions basic to this study were: (a) The curricular experiences of pupils are determined in large measure by the values, goals, skills and attitudes held by teachers and: (b) If the curriculum is to be changed and improved the educational values, goals, skills and attitudes of the people involved must be changed and these same qualities in respect to interpersonal relations among members of a working group must be affected.

The general plan of the study included: (a) inviting teachers to participate voluntarily in a two-semester project; (b) enlisting support of principal, department head, and specialist supervisor; (c) providing for bi-weekly meetings over two full semesters; (d) providing for guest speakers, special materials, films, visits to other schools, etc.; (e) author of this report serving as coordinator and organizer of group activities, encouraging members of group to undertake experimentation in their own classes and to report back to group; (f) measuring teachers' perception of roles of group's status people.

This study employed a case-study approach to a group of teachers engaged in an action-research project. The author of this report kept detailed minutes of group meetings, made observational records and analyses of members' behavior and interaction including their relationships with status figures, etc.

Findings of the study may be summarized in relation to each of five explicitly stated hypotheses. These hypotheses and related findings are:

Hypothesis A: There will be tangible modifications in classroom practices of teachers involved.

This hypothesis was found to be true, in general. Among the nine teachers who continued with the project throughout the year, seven undertook experiments which resulted in marked changes and improvements in instruction. Examples of these include: (a) initiation of core classes in classrooms of two of the teachers; (b) initiation, development and evaluation of a handwriting project; (c) development of a phonics spelling program; (d) composition, reading, and testing procedures tried out and evaluated.

Hypothesis B: A variety of instructional methods will be tried and tested.

This hypothesis, which is related to Hypothesis A above, was also, in general, borne out. One teacher compared two ways of teaching composition. Another tried a dictionary use experiment. A third switched from teaching of formal grammar to a method based on greater "individual analysis" and a way of teaching the "most

necessary" skills. Still another teacher carried out a highly detailed project involving relationships and skills between (a) reading for main thoughts, (b) recognition of context clues and (c) written expression of recognized ideas. Other instructional variations included employment of small group methods, self-correction techniques, etc.

Hypothesis C: There will be an increase in the confidence of teachers in defining problems.

All the teachers and two of the three administrators showed marked increase in self-confidence in stating and defining instructional problems between the first and the last month of the study.

Hypothesis D: Teachers will feel increasingly secure in exchanging suggestions with each other.

Definite change occurred in this respect in all but two of the twelve members. In several the changes were almost dramatic. However, in one member there was little change.

Hypothesis E: The head of the English Department and the principal will allow and encourage the teachers to try, test, and develop newer methods, techniques, and courses.

Evidence showed the principal gave strong support to all members. Evidence concerning the department head was inconclusive in this matter.

462 pages. \$5.90. Mic 57-2428

ADEQUACY OF RELATED TECHNICAL INSTRUCTION IN VOCATIONAL TRADE AND INDUSTRIAL EDUCATION IN TEACHING PRINCIPLES OF MATHEMATICS AND PHYSICAL SCIENCE

(Publication No. 21,499)

Byrl Raymond Shoemaker, Ph.D.
The Ohio State University, 1957

One important problem facing vocational educators preparing youth for entrance into skilled occupations in our industrial society is concerned with the effectiveness of the program in teaching the principles of mathematics and physical science required for success in such occupations. Statements by employers have indicated that high school graduates, including those from trade and industrial education programs, are deficient in the areas of mathematics and science.

In the trade and industrial education programs in Ohio's public schools, the principles of mathematics and physical science related to a trade are to be taught during a two-period block of time scheduled each day for related technical instruction. The study was designed to evaluate this plan for providing instruction in such principles. The hypothesis on which the study was based was that the present plan of instruction used to teach related technical information in trade and industrial education programs is not effective in teaching the principles needed by graduates.

Graduates from the machine trade programs who had been out of school for five and six years were selected to participate in the study. A review was made of the literature in the machine trade to establish a list of principles applicable to the trade. The list was submitted to a jury of

teachers in the machine trade for criticism and revision, and then to the graduates, who were asked to rate the principles from the standpoint of usefulness and to evaluate the effectiveness of the trade and industrial education program in the high school in teaching them.

The list of principles sent to graduates was condensed into topics of related technical information. The list of these was then sent to the immediate supervisor of each graduate participating in the program to check the accuracy of the responses of the graduates. The supervisor was asked to evaluate the graduate's need for instruction on the topics and his ability to apply the principles in his work.

The study indicated that the principles of mathematics and physical science established for the machine trade by the teachers were needed by the graduates on the job, and that while the graduates realized that an effort had been made to teach these principles, instruction in them had been inadequate.

Thus, the hypothesis--that the present plan of instruction is not effective in teaching the principles of mathematics and physical science--was proved correct. The plan, therefore, needs to be revised.

Recommendations based on the findings of the study are as follows:

1. Supervisors and teachers of trade and industrial education programs should be encouraged to improve instruction in the principles of mathematics and physical science related to the trade students are learning.

2. A study should be made of the relationship of teacher qualifications to the effectiveness of instruction in principles of mathematics and physical science in trade and industrial education programs.

3. A study should be made of the effectiveness of giving instruction in mathematics and physical science in separate periods, maintaining homogeneous grouping of students by trades in such classes.

4. A study should be made of the effectiveness of instruction in principles of mathematics and science provided by technical education programs which permit heterogeneous grouping of students from different areas of technical education.

160 pages. \$2.10. Mic 57-2429

THE USE OF MATERIALS IN THE TEACHING OF ARITHMETIC

(Publication No. 21,651)

David Sole, Ph.D.
Columbia University, 1957

Chairman: Howard F. Fehr

An experiment, involving 240 children in twelve classes, was designed to determine whether the use of a variety of materials in the teaching of a topic in arithmetic produces better results than the use of only one material.

The major conclusions of the experiment are given below. Naturally, it is recognized that any conclusions based on a single experiment like this must be considered tentative.

Using a variety of materials does not produce better results than using only one material if both procedures are used for the same time.

If a topic in arithmetic is taught by two methods, one using considerably more time than the other, then the method using more time produces better skill whether it uses a variety of materials or not. This may account for the claimed superiority of some methods using a variety of materials, but also using more time than is customary in the teaching of the topic.

The effectiveness of the learning of arithmetic depends more on the teacher than on the materials used. This would indicate that we should spend more time on the training of teachers, trying to give them a good understanding of the mathematics that they teach, rather than on the development of materials.

Arithmetic methods, materials, and time-schedules suitable for slow or average children may not be suitable for gifted children. Elementary school mathematics programs suitable for gifted children should be provided so

that these children will not be held back mathematically, but will progress in accord with their ability.

Educators must be careful not to confuse the manipulation of materials with the learning of arithmetic. Arithmetic is a set of ideas, not a system of concrete materials. While many aspects of arithmetic can be illustrated and explained by means of concrete materials, and while arithmetic has innumerable applications to concrete situations, a child has not learned arithmetic until he understands it as a system of ideas, not as a system of concrete illustrations. Materials may be used as a means of clarifying some of the ideas of arithmetic. Materials should be used only until the mathematical idea is understood by the pupil. After that, the child should concentrate on the mathematical idea rather than on the concrete material.

126 pages. \$2.00. Mic 57-2430

ENGINEERING

ENGINEERING, GENERAL

THE LINEAR PROGRAMMING PROBLEM

(Publication No. 21,430)

Mohamed Ibrahim Dessouky, Ph.D.
The Ohio State University, 1956

The study consists of three main parts. The first part is a survey of the status of linear programming. After an analysis of the impact of science on management, which resulted in the field of industrial engineering, an evaluation of the use of models in that field is made. A special emphasis is put on the linear programming model because of the great variety of problems to which it can be applied. The mathematical definition of linear programming is the maximization or minimization of a linear function of a set of variables which are restricted by a set of linear inequalities. The simplex method for solving the general case is presented briefly, with its mathematical background. The dual problem is shown, and its significance is pointed out. Examples are given of theoretical and practical applications of the model. Related problems involving transportation, the assignment, the traveling salesman, the caterer, and the network are presented, together with the relationships among themselves and with the general problem. After that, additional complexities are added to the model for the purpose of obtaining wider applications of it. The additions are quadratic and nonlinear forms, time (which transforms the static model to a dynamic one), and uncertainty.

The second part of the study is a presentation of some attempts to develop easier computation methods of solving the linear programming problem. The considerable computational effort required for the solution of these problems by present techniques points up the need for efficient methods. No positive results were obtained from the attempts presented.

In the last section two new approaches to the solution

of the problem are given. One is an elimination method according to which the criterion is transformed into a function of one variable. All the variables that can be eliminated are then removed from the set of inequalities except the criterion variable. This is given the maximum possible value that it can take and then so adjusted that the other variables will meet the non-negativity restriction. This approach is shown to be particularly useful when the number of inequalities is not too large or when each of the variables appears in a small number of equations. The second approach employs a transformation, taking advantage of a function presented by Kuhn and Tucker which replaces the original problem. The saddle point in the second problem corresponds to the optimum point in the original problem. According to this approach, the saddle point can be reached by a method of successive approximations.

148 pages. \$2.00. Mic 57-2431

ENGINEERING, AERONAUTICAL

A THEORETICAL STUDY OF THE AERODYNAMICS OF SLENDER AIRPLANES AND MISSILES

(Publication No. 21,579)

Alvin Howard Sacks, Ph.D.
Stanford University, 1957

A theoretical analysis is made of some of the aerodynamic characteristics and stability problems associated with slender airplanes and missiles. The analysis is made within the framework of slender body theory, and formulas are developed for the total aerodynamic forces and moments acting on a wide variety of slender configurations,

with the effects of vortex interference included. These formulas are applied to a number of wing-body, wing-tail, and wing-body-tail combinations.

A study of wing-body combinations having no afterbody has led to general formulas for the stability derivatives in terms of the mapping functions of the cross sections. The role of the apparent mass concept in slender-body theory has been clarified and a number of general relationships among the stability derivatives have been demonstrated. Since the pressure-velocity relation of slender-body theory is not a linear one, second-order derivatives have been obtained which bring out the interdependence of the longitudinal and lateral motions of the aircraft.

Calculations are made of the variations of total forces and moments with angles of attack and sideslip acting on a number of slender wing-tail combinations. The calculations are made under the assumption that the vortex sheet leaves the wing as a flat sheet and becomes fully rolled up ahead of the tail. The effects of changes in tail height, tail length, ratio of tail span to wing span, tail incidence and tail thickness are calculated. The resulting curves, and particularly their nonlinearities, are discussed at some length in connection with static stability. In general, the most drastic effects are noted when the vortices shed from the wing strike or pass near the tips of the tail trailing edge.

A complete analytical solution is found for the classical hydrodynamic problem of a symmetric two-dimensional vortex pair moving past a circular cylinder, and this solution is applied to calculate the lift on the cylindrical afterbody and tail of a slender missile due to incidence of the wing.

The influence of the tail on the paths of the vortices shed by the wing has been investigated experimentally by means of a water tank. The angle of attack at which the high tail is observed to sever the vortex cores is in very good agreement with the angle calculated in the analysis. On the other hand, the tail is found to cause a noticeable inboard shift of the wing vortices for the case tested. This effect is not included in any present theory and may be of general interest.

221 pages. \$2.90. Mic 57-2432

ENGINEERING, CHEMICAL

KINETIC STUDIES IN VAPOR PHASE ESTERIFICATION

(Publication No. 21,434)

Richard Albert Fitz, Ph.D.
The Ohio State University, 1956

The purpose of the research program was to evaluate analysis of initial reaction rate data as a method of determining possible rate mechanisms and reaction rate equations for heterogeneous catalysis. A reversible reaction involving a two-component reactant mixture was desired in order to test the applicability of this method.

Vapor phase esterification of an alcohol and an acid on the surface of a solid catalyst met the requirements, and was chosen as the reaction for study. The systems studied

were ethanol - acetic acid, n-butanol - acetic acid, and n-butanol - n-butyric acid. The catalyst used was a low iron, low silica bauxite.

The experimental program was designed to obtain kinetic data at 255° C. Feed composition, vapor velocity, and pressure were varied independently. Results showed that small decreases in initial rates occurred when the alcohol activity was constant while the acid activity was increased from 0 to 1.0 atmosphere. However, when the alcohol activity was 0.2 atmospheres or greater, an increase in alcohol activity resulted in a proportional increase in the reaction rate.

The results also show that the partial pressure of the products in the fluid stream has little effect on the rate of reaction.

None of the theoretical rate equations for surface reaction or sorption accounted for the experimental results. However, the general form of the initial reaction rate equation for alcohol adsorption seemed to express, qualitatively, the behavior of the systems. Empirical modified adsorption equations were developed which reproduced the data within 5 per cent.

The empirical equation for the ethanol - acetic acid system is:

$$r_o = \frac{0.00876 a_{Alc} 0.57}{1 + \frac{0.20}{(a_{Alc})} (a_{Acid})}$$

where r_o is the initial reaction rate in g-moles converted per gram catalyst per hour and the activities are expressed in atmospheres.

For the n-butanol - acetic acid system, the empirical equation is:

$$r_o = \frac{0.00928 a_{Alc} 0.57}{1 + \frac{0.07}{(a_{Alc})} (a_{Acid})}$$

The theoretical rate equation for the adsorption of alcohol is:

$$r_o = \frac{k a_{Alc}}{1 + K_{Acid} a_{Acid}}$$

where k is a constant and K_{Acid} is the acid adsorption equilibrium constant.

Several basic assumptions were made in the derivation of the theoretical equations which might not be valid in this case. The adsorption equilibrium constants for each component were assumed to be independent of the concentration of the other component. Also, all active centers were assumed to have the same activity and to be readily accessible to the reactants. The empirical equations suggest that the acid equilibrium constant may be dependent on the alcohol activity. Experimental data indicate that the acid is rapidly adsorbed and probably covers most of the active sites.

Identical exponential terms for alcohol activity were found for both the alcohols studied. A small increase in reaction rate resulted when the higher alcohol was used. The higher acid gave a drastically reduced reaction rate. This result supports the speculation that acid is highly and rapidly adsorbed, and limits the number of active sites available for alcohol adsorption.

119 pages. \$2.00. Mic 57-2433

**MECHANISM OF A TWO PHASE REACTION
ETHYLATION OF TOLUENE**

(Publication No. 20,552)

Georges Gau, Ph.D.
University of Minnesota, 1956

The two-phase Friedel-Crafts ethylation of toluene in presence of AlCl_3 , has been studied under conditions of saturation with ethylene. It has been found that the aluminum chloride catalyst is deactivated by the higher ethyltoluenes, the rate of deactivation being a function of the temperature and of the amount of catalyst. The ratio of the isomers obtained depends upon the speed of alkylation and the amount of catalyst and is independent of the temperature. The relative amounts of the several alkylated compounds is a function of the temperature, amount of catalyst and speed of alkylation.

A mechanism has been proposed in which the alkylation, complex formation, isomerization and disproportionation reactions are considered. Some thermodynamic and kinetic considerations of a two-phase reaction system have been presented and utilized for the establishment of the rate equations; the mathematical procedure required for the determination of the constants figuring in the rate equations has been suggested. 101 pages. \$2.00. Mic 57-2434

THERMAL CONDUCTIVITY OF PROPANE

(Publication No. 21,690)

Douglas Ellis Leng, Ph.D.
Purdue University, 1956

Major Professor: E. W. Comings

The effect of pressure on the thermal conductivity of propane at temperatures of 122, 154, 189, 222 and 284°F , of ethane at 154°F and of nitrogen at 122°F has been investigated up to pressures of 280 atmospheres. Particular attention was given to the behavior of the thermal conductivity of propane near the critical region.

Measurements were obtained using the concentric gas layer type thermal conductivity cell described by Lenoir in 1951 modified for use at high temperatures. Heat was supplied by hot oil circulating through the outer layer of the cell and, after passing radially inward crossing two very thin concentric gas filled annuli, was removed by a stream of cool oil flowing through the center of the cell. The inner annulus contained the sample to be measured, while the outer annulus was filled with helium at 20 psig. and served only as a constant thermal resistance. The ratio of the temperature gradients, measured by means of three thermocouples located in the steel walls on each side of the annuli at the mid-point of the cell, was a function of the thermal conductivity of the gas in the inner annulus. The thermal conductivities of unknown samples were determined from a calibration curve obtained using four gases of known thermal conductivity.

The thermal conductivity of propane, at 122°F and pressures from the vapor pressure to about 280 atmospheres, was found to increase, then decrease, forming a "hump" and finally increase continuously. Similar irregularities

were observed at 154°F and 189°F , although the magnitude of the "hump" was observed to decrease with increasing temperature. Viscosity isotherms for propane reported by Smith and Brown in 1943 indicate a change in slope in the same region at which the "hump" occurred in the thermal conductivity isotherms. These irregularities in properties of propane are believed to be caused by a molecular rearrangement similar to the type considered by Eyring and co-workers in 1953.

A sharp peak observed in the thermal conductivity of propane at 222°F near the critical pressure was found to be due to convection, which was probably caused by the formation of molecular clusters as reported by Kreglewski in 1954.

The data for propane and ethane were compared with the generalized correlations of Comings and Nathan, and Lenoir, Junk and Comings, at reduced temperatures of 1.03 and 1.11. At a reduced temperature of 1.03 and a reduced pressure of 5.0, the measured thermal conductivities of propane and ethane were respectively 60% and 46% less than the values predicted by the correlations. A similar behavior was observed at a reduced temperature of 1.11.

It was concluded that the above generalized correlations could not be used to predict the thermal conductivity of complex gases at temperatures near the critical temperature.

A correlation was proposed, whereby the ratio of the measured thermal conductivity to the calculated thermal conductivity for carbon dioxide, ethylene, ethane and propane was shown to be a function of the number of modes of vibrational freedom for constant values of the reduced temperature and reduced pressure.

150 pages. \$2.00. Mic 57-2435

**A KINETIC STUDY OF THE CATALYTIC
HYDROGENATION OF ALDEHYDES**

(Publication No. 21,035)

Charles Clifford Oldenburg, Ph.D.
The University of Texas, 1957

Supervisor: Howard F. Rase

Acetaldehyde, propionaldehyde, and *n*-butyraldehyde were hydrogenated to the corresponding alcohols in the vapor phase over a supported nickel catalyst in a kinetic study of the reactions. One purpose of this study was to determine the feasibility of correlating kinetic data, for engineering purposes, on members of a family of compounds. Another purpose was to develop improved methods for the engineering application of kinetics.

Gaseous mixtures of hydrogen and aldehyde were pre-heated and caused to flow through a differential isothermal reactor containing twelve $1/8$ " catalyst pellets. The pellets were arranged vertically in a $1/4$ " tube and spaced at $1/8$ " intervals. This arrangement provided adequate heat transfer surface for satisfactory reaction temperature control. Liquids were condensed from the reactor effluent and continuously analyzed by an infrared spectrophotometric technique. The range of operating conditions included 120 to 180°C ., 20 to 60 psia., 1.5 to 7 g.moles per hour per gram of catalyst, and feed compositions with a range of 0.4

to 0.7 mole fraction hydrogen. Conversions were in the range 0.5 to 4 per cent.

Initial rates of reaction were determined at various operating conditions for each aldehyde. Results indicated that at given operating conditions, the initial rate of hydrogenation increased from acetaldehyde to propionaldehyde to n-butyraldehyde. The data were treated by the extended Langmuir-Hinshelwood theory as applied by Yang and Hougen. The data suggested that the reaction mechanism involves adsorption of aldehyde, adsorption of hydrogen without dissociation, surface reaction, and desorption of alcohol; the slowest or rate controlling step is evidently the adsorption of aldehyde. The following initial rate equation is associated with this mechanism:

$$r_o = \frac{(k_u EL) P_u}{1 + K_H P_H} \quad (1)$$

where r_o = initial rate of reaction, g.moles of alcohol produced per hour per gram of unreduced catalyst

E = overall effectiveness factor

L = total number of molal adsorption sites per unit mass of catalyst

k_u = aldehyde adsorption velocity constant

K_H = adsorption equilibrium constant for hydrogen

P_u = partial pressure of aldehyde

P_H = partial pressure of hydrogen

Values of $(k_u EL)$ and K_H were calculated for each aldehyde at several temperatures and correlated by the Arrhenius equation. Results were as follows:

$$\ln(k EL) = -\frac{A}{RT} + B \quad (2)$$

$$\ln K = -\frac{A}{RT} + B \quad (3)$$

	Acetaldehyde	Propionaldehyde	<u>n</u> -Butyraldehyde
A	+3380	+13,100	0
B	-0.670	+10.6	-3.65
A	+894	+15,600	-13,800
B	-0.632	+15.3	-17.6

Values of the Arrhenius constants do not seem to be correlated by any property of the aldehyde.

The data were also fitted to an empirical initial rate equation

$$r_o = \frac{k P_u}{V P_H} \quad (4)$$

where k = empirical rate constant.

Values of k were calculated for each aldehyde at several temperatures and correlated by the Arrhenius equation. Results were as follows:

$$\ln k = -\frac{A_s}{RT} + B \quad (5)$$

	Acetaldehyde	Propionaldehyde	<u>n</u> -Butyraldehyde
A_s	+7890	+7810	+7730
B_s	+4.94	+5.17	+5.31

These values indicate a relatively constant energy of activation (A_s) and a frequency factor (B_s) that increases with molecular weight of the aldehyde.

Treating the data by the empirical method resulted in a better fit by equations (4) and (5) than by equations (1), (2), and (3) representing the theoretical method. Therefore, the empirical method not only provided a basis for comparing the relative reactivities of the three aldehydes but also fitted the data better than did the theoretical method.

The observation that the initial rate of hydrogenation of n-butyraldehyde was greater than propionaldehyde and this greater than acetaldehyde, was explained by applying the inductive effect to the transformation taking place in the slowest or rate controlling step.

227 pages. \$2.95. Mic 57-2436

MECHANICS OF TWO-PHASE FLOW: COCURRENT COUNTERGRAVITY FLOW OF IDEAL VERTICAL FLUIDIZED SYSTEMS

(Publication No. 20,159)

Donald Lewis Struve, Ph.D.
Princeton University, 1956

A basic theory of vertical fluidized systems is presented. This theory is based upon the assumption that a single fundamental relation exists between the void fraction and the slip velocity between particle and fluid irrespective of the relative direction of flow of fluid and particles relative to each other and relative to the walls. The theory permits prediction of void fraction (or holdup) for any superficial particle and fluid flow rates. The theory also classifies and interrelates the following combinations of directions of particle and fluid flow relative to the walls:

1. Cocurrent cogravity flow
2. Countercurrent flow
3. Cocurrent countergravity flow
4. Batch fluidization (zero net particle flow).

Previous studies have verified the assumption of a single fundamental relation between void fraction and slip velocity for countercurrent flow and batch fluidization. This investigation was undertaken to test the applicability of the theory to cocurrent countergravity flow.

The cocurrent countergravity flow and batch fluidization of two ideal fluidized systems were studied experimentally in a 1 in. diameter column. The systems were 0.0184 in. diameter glass spheres-water and 0.00396 in. diameter glass spheres-water. Holdup, pressure drop, and fluid and particle velocities were measured for the cocurrent countergravity flow experiments. Holdup and fluid velocity were measured for the batch fluidization runs.

Calculated slip velocities for cocurrent countergravity flow and batch fluidization gave a single curve when plotted against holdup. It is therefore concluded that the experimental results support the validity of the basic assumption for the cocurrent countergravity flow of liquid-solid systems.

The experimental data for cocurrent countergravity flow are in excellent agreement with the operating diagram (holdup as a function of fluid and particle velocities) for cocurrent countergravity flow determined from the holdup-slip velocity relationship obtained from the batch fluidization experiments. Stable operation in the cocurrent countergravity flow region where the fluid velocity is less than the single particle transport velocity is possible

provided there is mechanical support for the solids and the solids flow rate is controlled at the bottom of the column. The application of the theory to the prediction of behavior in compound cocurrent counter-gravity flow fluidized systems is demonstrated.

The holdup of the packed bed obtained by slowly decreasing the fluid velocity in a batch fluidization experiment is the upper limit of holdup for complete fluidization. For greater holdups, the theory does not apply as the system is only partially fluidized.

The total pressure drop for cocurrent counter-gravity flow, less a correction for fluid-wall friction loss, is the same as the static pressure drop calculated from the holdup. There is no significant solids-wall friction pressure drop.

This basic theory was developed and tested only with regard to vertical ideal fluidized systems. With suitable modification of the theory and more comprehensive batch fluidization correlations, it is believed that the behavior of any vertical fluidized system operating in any flow regime may be predicted from a batch fluidization correlation without recourse to actual experimentation.

147 pages. \$2.00. Mic 57-2437

ENGINEERING, CIVIL

A STUDY OF THE AIR-VOID CHARACTERISTICS OF HARDENED CONCRETE

(Publication No. 21,280)

Fulton Keller Fears, Ph.D.
Purdue University, 1957

Major Professor: K. B. Woods

The theory of the action of entrained air in producing frost-resistant concrete demonstrates the importance of the size and distribution of the air voids in the portland-cement paste. In this investigation the linear traverse technique was used to determine the air-void characteristics of hardened concrete. The characteristics investigated were: (a) Air content, total volume of voids per unit volume of concrete; (b) Number of voids intersected per unit length of traverse; (c) The specific surface of the air voids, the surface area of the voids per unit volume of air; (d) Number of hypothetical spheres of equal radius having the same volume of air per unit volume of concrete and the same specific surface as the actual system of random sized voids; and (e) Spacing factor, distance from void boundary to outer boundary of sphere of influence. To compute the void-spacing factor for the hypothetical void system each sphere is considered to be at the center of a cube with the sum of the volumes of all such cubes and the enclosed spheres equaling the combined air and paste content of the concrete. The sphere of influence of each void is the radius of the sphere circumscribing the hypothetical cube. The air content and the number of voids per unit length of traverse were measured directly. The remaining characteristics were computed from these two measurements with the paste content being introduced in the computation of the spacing factor.

Statistical methods were applied to the study of the variability of the air content and number of voids per inch within a concrete beam 3 x 4 x 16 inches. The analysis showed that the measurement of these characteristics for a particular beam may be considered as one long traverse without regard to the position or length of the individual traverses. To determine the air content within ± 0.5 percent of the true value at the 90 percent confidence level a total length of traverses of 200 inches is suggested.

Forty cores taken from a concrete pavement were examined. The study of the variability of the air content and number of voids per inch as shown by these cores suggests that for the sampling of pavements, cores be taken at random along the stretch of pavement and measurements made on one surface of each core.

Thirty-eight beams from nineteen mixes were used to study the correlation between each of the five air-void characteristics and durability. These beams had shown varying degrees of durability as measured by resistance to deterioration in laboratory freezing and thawing tests. Durability factors were used to express the durability of each of these beams. The five air-void characteristics ranked in the order of their correlation with durability beginning with the one showing the best correlation are: (1) spacing factor, (2) specific surface, (3) number of voids per inch, (4) hypothetical number of voids per cubic inch, and (5) total air content.

The spacing factor and the specific surface were found to be of almost equal importance in producing durable concrete. Hence, either of these two characteristics may be used as a criterion for determining the air requirements for frost-resistant concrete.

126 pages. \$2.00. Mic 57-2438

THEORY OF FOLDED PLATE STRUCTURES

(Publication No. 21,293)

Howard Leon Leve, Ph.D.
Purdue University, 1957

Major Professor: Dr. John E. Goldberg

This thesis presents and illustrates a classical theory, outlined and formulated by J. E. Goldberg, for prismatic folded plate structures. This theory considers the simultaneous plate bending and membrane action of the several slabs within the usual assumptions of plate and elasticity theory plus the restrictions that no displacements are permitted in the planes of the end diaphragms and no resistance is offered normal to these planes.

The forces at the longitudinal edges of each slab are expressed as fixed-edge forces corrected or modified by the effect of displacement of the joints. These displacements are visualized as being four in number at each point of the joint: two components of translation and a rotation, all lying in the plane normal to the joint, and a translation in the direction of the joint. It is assumed that the joint displacements can be expanded into Fourier half-range series. At each longitudinal edge of a slab, four distributed generalized forces will exist namely, a force in the plane of the slab and normal to its edge, a shear in the direction of the thickness, a longitudinal shear, and an edge moment. Each of these distributed generalized forces is linearly

dependent upon the four components of displacement at both edges of the slab and may also be expanded into Fourier series.

The relation between the four generalized edge forces and the displacements is determined *a priori* by a semi-inverse technique which is essentially typical for each component. A single harmonic of one of the displacements is applied to one edge of the slab and the resulting homogeneous boundary value problem is solved for the displacements within the slab. These displacements define the resulting forces in the interior of the slab and, in particular, they establish the forces at each edge due to the element of displacement at one edge. These edge-force - edge displacement relations are used in writing the joint equilibrium equations as well as in evaluating the fixed edge forces of the loaded slabs.

By the above approach compatibility at each joint is automatically satisfied and it is only necessary to handle $4n$ equilibrium equations, where n is the number of joints with unknown forces and displacements. These latter equations are similar in form to those used in the slope deflection method, thus eliminating the use of differential equations. A simplification in the solution of the equilibrium equations is obtained by the proper orientation of the joint axes.

To facilitate the use of the classical theory, fixed edge forces are derived for four cases: namely, a uniform load normal to the slab, one case of a uniform load in the plane of the slab, an arbitrary loading normal to the slab, and an arbitrary loading in the plane of the slab.

To illustrate the use of the theory, examples of a three-slab folded plate structure with fixed, free, and elastically supported boundaries are solved for three harmonics. For the elastically supported case, an edge beam is analyzed in a manner similar to that stated above for the slabs.

The problem of five joint forces and only four possible joint displacements arises for the edge beam, as well as the slabs. For the edge beam it is shown by the calculus of variations that two of the joint forces, namely, the plate shear and twisting moment, have always a certain coupling which reduces the number of independent joint forces to four.

179 pages. \$2.35. Mic 57-2439

PROBABILITY OF FATIGUE FAILURE OF CONCRETE

(Publication No. 19,424)

John Thompson McCall, Ph.D.
Purdue University, 1956

Major Professor: Joseph L. Waling

Fatigue tests were run on concrete beams and the data were analyzed in an attempt to determine the relationship for concrete between stress (S), number of cycles to failure (N), and probability of failure (P).

Prismatic concrete beams were loaded in completely reversed bending at the rate of 1800 cycles per minute. Beams were tested at two stress levels and the number of cycles necessary to cause failure were determined. Testing was stopped at ten-million cycles if failure had not occurred.

S-N curves for several probabilities of failure, P , were obtained graphically. Several mathematical relationships for S-N-P were investigated for their applicability to the data obtained for concrete.

It was concluded that the S-N-P relationship for concrete could be obtained graphically from the observed data, and that one of the mathematical relationships investigated was valid for the concrete tested. It was also concluded that a definite fatigue limit for the concrete studied does not exist (in a range up to ten-million cycles) and it was estimated that the probability of concrete exceeding a fatigue life of ten-million cycles is one-half - if the alternating stress amplitude is one-half of the ultimate strength and the mean stress is zero.

74 pages. \$2.00. Mic 57-2440

A STUDY OF THE INTERNAL CHANGES IN STRAINED CONCRETE SPECIMENS USING COLLIMATED GAMMA RADIATION

(Publication No. 21,585)

Terry Triffet, Ph.D.
Stanford University, 1957

The results of a series of experiments are presented in which it is established that systematic variations in the intensity of a narrow beam of gamma radiation passing through a concrete compression specimen occur with increasing load. These variations are shown to be approximately proportional to compressive stress over the intermediate loading range and to possess maximum significance and reproducibility for concretes of medium strength. Despite the fact that they appear to be analogous in some ways to unit axial strain, the variations cannot be accounted for by specimen deformation; and it is concluded that they are controlled by changes in material density resulting from changes in internal structure. This conclusion is confirmed by independent film density measurements. By comparing measured radiation intensities with intensities computed from considerations of specimen deformation and radiation absorption, the effect of density changes is estimated and found to be five or six orders of magnitude greater than that of unit lateral strain. In the course of this development it is also established that the beam of gamma radiation used for the experiments was sufficiently homogeneous to permit use of the classical absorption law, and that the distribution of aggregate of a given size group in the concrete was sufficiently random to be described by a Poisson distribution. One equation is presented which relates the change in radiation intensity to unit compressive stress for different types of concrete and radioactive sources, and another from which the number of pieces of aggregate of any desired size appearing in an arbitrary volume in a concrete structural member may be determined from the properties of the mix. The potential importance of this method of measurement in the field of non-destructive stress analysis is discussed, and it is noted that the sensitivity of the method to density changes and its ability to integrate all events occurring in the path of the radiation beam suit it particularly well for the analysis of stresses in inhomogeneous materials. Examples of possible computational techniques are

given; and, in conclusion, suggestions are made for future research. 194 pages. \$2.55. Mic 57-2441

ENGINEERING, ELECTRICAL

USE OF THE FREQUENCY DOMAIN IN ELECTRONIC DIGITAL COMPUTERS

(Publication No. 21,562)

Kohei Amo, Ph.D.
Stanford University, 1957

The possibility is investigated of building a computer in which numbers are represented by preassigned discrete frequencies. This principle of using discrete frequencies is based on the invention of the frequency-memory register by Dr. W. A. Edson.* Because the frequency-memory register, which is essentially a multi-mode oscillator, can have as many modes as is desired, a number system having any desired radix can be employed. These ideas of using frequencies and any one of the many possible radix systems give a remarkable contrast between the computer proposed herein and the conventional computers in which the numbers are represented by a series of binary pulses.

Consideration is limited to two main components of the proposed computer, the storage unit and the arithmetic unit.

The frequency-memory register is reviewed; it consists essentially of a multi-mode oscillator which can sustain any one of the mode frequencies after that frequency is injected for a short interval. To insure stable operation the frequency-memory register must include a nonlinear unit which gives amplitude discrimination and a unit which prevents phase modulation.

The multi-digit frequency-memory system, which stores numbers of more than one digit (whatever the chosen radix), is then explained. A system employing a long delay line is proposed; an experimental unit was fabricated and tested with successful results. If a series of pulse-modulated r-f signals, having frequencies of f_1, f_2, \dots, f_n , respectively are fed into the input of this system, they will circulate in the loop until the power is cut off. The numbers 1, 2, ..., n are stored in the delay line in the form of allocated corresponding frequencies.

Finally, the decimal counter in the frequency domain is briefly discussed and the problems pertaining to the switching of frequencies are considered.

An arithmetic unit as contemplated in the new art can be built simply by combining modulators, filters, and gate circuits - all well-known radio-engineering devices. Consideration is given to four arithmetic units, the adder, subtracter, multiplier, and divider which are all based on the decimal number system.

Many block-arrangement designs are presented for adders, each varying in the way of handling the carrying process. Proposed are the step-by-step, the ripple-through, and the simultaneous carry processes. Comparisons and evaluations of these arrangements are made. The design for an accumulator is offered which is really a simple modification of the adder.

Designs for subtraction operations, based on the direct method and on the addition of complement representations, and designs for systems to multiply, based on either the direct method or the repeated addition method, are submitted and illustrated. Likewise a design for a divider using the repeated subtraction method is given.

Evaluation of solutions to the radix problems and to the speed involved in operations by this new kind of computer are discussed. Finally, clarification and verification of theoretical statements are made by the presentation of findings from laboratory experiments which were made in the low-frequency regions. The system was fabricated and consisted of a multi-digit frequency-memory system with tape recorders for the long-delay units, an adder, and a crystal filter.

This new principle of using frequency in a computer can be used to produce one which will perform almost any function currently performed by a conventional computer, if cost is not considered. Furthermore, the new art seems to promise very high speeds in computer operation if the microwave frequency range were to be utilized. One example calculated in the report gives the value of 355 millimicroseconds for adding two ten-digit numbers. Equally promising is the adaption of the decimal number system, which would give many unique characteristics to a computer. Among possible novel improvements would be the simplicity of programming without the need for translating decimal numbers into the binary system as is presently done. Also, such a system would offer the great advantage of a largely increased storage capacity. It is hoped further work and experimentation will be undertaken.

249 pages. \$3.25. Mic 57-2442

*Dr. W. A. Edson was a member of the Stanford Electronics Laboratories staff at the time of the project this report describes; he is now Consulting Professor at Stanford University and on the staff of General Electric, Palo Alto.

INTENTIONALLY NONLINEAR NETWORKS FOR SERVO SYSTEMS (PARTS I AND II)

(Publication No. 21,683)

John Cardwell Clegg, Ph.D.
University of Utah, 1957

Chairman: L. Dale Harris

PART I NONLINEAR LEAD NETWORK

Fig. 1 shows the circuit diagram of the nonlinear phase lead network consisting of two diodes, two capacitors, four resistors, and one transformer. The network is suitable for use in either d-c or a-c servomechanisms. In a-c systems, this network has several advantages over other lead networks. First, no tuned circuits are involved which would be upset by changes in carrier frequency. Second, no inductances are involved which would be heavy, expensive, and in general difficult to use at low frequencies.

Third, precision components are not required as in other a-c lead networks.

The thesis explains the theory of operation of this network and gives experimentally determined characteristics. Plots of magnitude and phase angle versus normalized frequency are given for two variations of the basic network and for several typical values of network parameters. These plots can be used directly for design by any engineer familiar with the use of conventional lead networks.

A method is described for accurately measuring the magnitude and phase angle of the fundamental component of the output of any linear or nonlinear servo system or component, and a detailed description of the required apparatus is included.

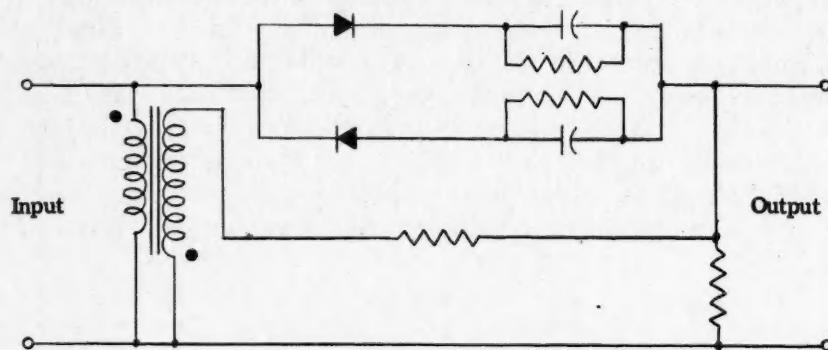


Fig. 1. Nonlinear lead network

PART II NONLINEAR INTEGRATOR

In the second part of the thesis is described a method of connecting diodes to an electronic integrator in such a manner that the output of the integrator is reset to zero every time the input changes polarity. This nonlinear integrator has all of the advantages of a linear integrator in reducing steady-state errors, but introduces at most only 38.1 degrees of phase lag compared to the 90 degrees of phase lag caused by a linear integrator.

A servo system is described in which the nonlinear integrator is used to reduce the steady-state error by a factor of 8 while introducing only 11 degrees of phase lag at the natural frequency of oscillation and causing the overshoot in its step-function response to increase only slightly.

88 pages. \$2.00. Mic 47-2443

NOISE GENERATED IN OXIDE CATHODES

(Publication No. 20,512)

Herbert James Hannam, Ph.D.
University of Minnesota, 1956

Major Adviser: A. van der Ziel

Noise measurements were performed on oxide coating used as bulk material and as a normal thermionic emitter.

Measurements on bulk coating at 8 mc show that the noise is in excess of thermal noise for temperatures at which the break in the conductivity curve would occur. This can be explained in terms of the porous semi-conductor model of the oxide cathode.

Low frequency measurements on bulk oxide coating show that the noise is exponentially decreasing for increasing temperature when the coating temperature is above that at which the break in conductivity occurs. When low frequency noise measurements are made at constant coating current with coating temperature as a variable the flicker noise drops abruptly as the conduction switches from pore conduction to grain conduction. This indicates that the main source of excess noise is the fluctuation in the conductivity of the pores.

Noise measurements on diodes show that flicker noise is influenced by drawing current to an anode on which evaporation products from the cathode have been deposited as soon as the anode voltage is in excess of 10 volts. The pulsed emission also decreased at the anode voltage at which the flicker noise starts to increase. This effect can be explained as the electronic dissociation of oxides which have evaporated to the anode. This effect can be reduced by increasing the cathode temperature, by using more active Ni alloys, or by making an open anode structure so that less of the liberated oxygen reacts with the cathode.

When other noise sources of noise in these diodes are eliminated there seems to be a certain inherent flicker noise level which increases exponentially with increasing temperature. This temperature dependence and the associated activation energy can be explained by assuming that the noise is proportional to the rate at which free metal atoms (or ions) arrive at or are released by the surface. The following processes are active simultaneously.

- Evaporation of metal atoms from the surface
- Release of new metal atoms at the interface due to the reaction of the oxide with impurity atoms in the nickel (governed by the diffusion of the impurity through the nickel).
- Diffusion of the free metal atoms through the pores. The noise is due to fluctuations in the rate at which these three processes occur.

Since these processes are surface processes, it is not unreasonable that they lead to a $1/f$ spectrum. When only this inherent noise level is present, the results show that an inactive base metal gives the lowest noise, as would be expected by the above explanation.

74 pages. \$2.00. Mic 57-2444

HARMONIC GENERATION BY CRYSTALS AT MICROWAVE AND MILLIMETER WAVE FREQUENCIES

(Publication No. 21,522)

Ying-chen Hwang, Ph.D.
University of Maryland, 1957

Supervisor: Professor Joseph Weber

The art of crystal harmonic generation at microwave and millimeter wave frequencies is reviewed and the results of a theoretical and experimental study are discussed. The causes of low efficiency are understood. Multipliers were constructed which gave better performance (by 4 to 10 decibels) for the second and third harmonics, than previously reported multipliers. Improvement was achieved

by improving the power transfer to the crystal and by control of the length, contact, and pressure of the whisker. Some improvement was also achieved by a two phase arrangement. Power inputs of the order of thirty milliwatts were employed with harmonic outputs exceeding one milliwatt, in many cases. 86 pages. \$2.00. Mic 57-2445

**CLOSELY SPACED TRANSVERSE SLOTS
IN RECTANGULAR WAVEGUIDE**

(Publication No. 20,866)

Richard Frank Hyneman, Ph.D.
University of Illinois, 1957

The traveling wave modes associated with the infinite, periodic structure consisting of closely spaced transverse slots in rectangular waveguide are considered. An approximate equation for the propagation constants of these modes for the case of infinitesimal thickness of the slotted wall is derived through Fourier Analysis techniques and an approximate application of the Reaction Concept. Theoretical results are given for two special cases, a) discretely spaced slots which extend completely across the broad face of the waveguide, and b) infinitesimally spaced slots of arbitrary length. In the homogeneous case considered, it is found that two dominant modes may exist, an attenuated fundamental mode representing a perturbation of the dominant TE_{10} mode in closed rectangular waveguide, and an unattenuated surface wave, with phase velocity less than that of free space, which is similar to the wave associated with a corrugated surface waveguide. Essentially independent control of the attenuation constant and phase velocity of the fundamental mode is possible over a wide range through the appropriate variation of the various physical parameters. Curves are given for the propagation constant in terms of these parameters, and the results of experimental measurements are shown to be in close agreement with the theory. 125 pages. \$2.00. Mic 57-2446

**THEORETICAL AND EXPERIMENTAL
EVALUATION OF THE REBATRON —
A RELATIVISTIC ELECTRON
BUNCHING ACCELERATOR**

(Publication No. 20,868)

Irving Kaufman, Ph.D.
University of Illinois, 1957

The development of sources of appreciable RF power in the 1 mm to 0.1 mm wavelength range of the electromagnetic spectrum has yet to be accomplished. A very promising approach to this problem is the use of a tightly bunched, megavolt electron beam as a current that interacts with a circuit tuned to this range of the spectrum, or as the coherent source that produces this power by direct radiation.

Work on a device for producing such a beam has resulted in a compact relativistic electron bunching accelerator, designated the REBATRON. One form of rebatron

consists of an electron gun, followed by two cavities that are powered by a high power microwave source. Calculations have shown that it may be possible to achieve very short, high density electron bunches from this rebatron, corresponding to strong harmonic content of up to the two-thousandth harmonic of the 3000 mc/s source. The origin and initial design of this rebatron is the work of Professor P. D. Coleman.

Two nearly identical models of such a rebatron have been constructed at the University of Illinois. Before using them to attempt the difficult problem of generating submillimeter waves, it was important to know if their behavior was as expected from the theoretical calculations.

A direct measurement of the rebatron output current waveform involves the measurement of pulse times of 10^{-13} seconds and therefore has obvious complications. The momentum spectrum of this electron beam is readily measured, however. If close agreement could be obtained between measured and calculated momentum spectra of the rebatron beam, then experimental agreement with calculated current waveforms would be implied, since both sets of data are obtained from the same equation of electron motion.

This thesis treats the following topics related to our rebatron:

1. A discussion of the theory of the rebatron.
2. Results of many sets of calculations, that show that the rebatron is theoretically capable of generating tight electron bunches for a wide choice of parameters.
3. An investigation of the tolerance problem, that has revealed that except for the production of very high harmonics (above the 500th), no special systems for stabilizing rebatron parameters should be needed.
4. The comparison between many theoretically computed and experimentally measured momentum spectra. The excellent agreement obtained here, by implying similar agreement of experimental with theoretical current waveforms, has given us confidence that our rebatron functions very nearly as computed.
5. Direct measurement of relative amplitudes of the 26th harmonic in the beam, for several sets of parameters. The results here correlated well with theoretical data and have given additional indication of the correct operation of the rebatron.
6. A number of miscellaneous topics related to further improving the operation of the rebatron.

331 pages. \$4.25. Mic 57-2447

**INTERACTION-IMPEDANCE MEASUREMENTS
BY PERTURBATION OF TRAVELING WAVES**

(Publication No. 21,572)

Richard Perry Lagerstrom, Ph.D.
Stanford University, 1957

Three methods of perturbing traveling waves on periodic slow-wave structures are analyzed as techniques for evaluating the interaction impedance of structures suitable for traveling-wave tube and backward-wave oscillator operation. A perturbation integral relating the fields at a material perturbation to a resulting change in the propagation

constant of a single mode is derived. The integral is almost identical to Kino's normal-mode perturbation expression assuming a small change in propagation constant. A dielectric-rod perturbation placed in a non- Θ -varying field is analyzed without the usual assumption that the field be uniform or that the radius or dielectric constant be small. Thus, correction factors for rods of finite size are obtained, and the effective dielectric constant is compared with conducting-rod perturbations which have been analyzed by Kino. The latter are found to give more perturbation for a given radius, but the dielectric rod can afford appreciably more selection of the TM fields over the TE portion of the wave. Curves and formulae are given for evaluating impedance from measured data of both perturbed standing waves (on a resonated structure) and traveling waves.

A longitudinal string of conducting needles, spaced with the same period as the structure, is proposed for separating Θ - and z -varying space harmonics by virtue of their essential orthogonality in these two coordinates. A perturbation formula is presented, with examples of the anticipated simple space pattern obtained by moving the needles in both the Θ - and z -coordinates in the fields of a single traveling wave. A Fourier integration is not required to separate the dominant harmonics. The presence of more than one space harmonic should be easily detected as a sinusoidal departure from a constant perturbation. A small stretchable helix is also proposed, with a qualitative discussion of the nature of its effect, as a velocity sensitive perturbation resembling an electron beam.

Experimental methods and sources of error are discussed. Experimental data obtained with dielectric- and metallic-rod perturbations of a tape helix are found to be in close agreement with the beam-measured data of Watkins and Siegman for essentially the same helix. The variation of the correction factors with dielectric constant and radius is found to be self-consistent, and is related accurately to the metallic-rod measurements when the TE fields are accounted for. 144 pages. \$2.00. Mic 57-2448

A mathematical analysis of the problem was also indicated. The purpose of this analysis was to determine the variation of the flow pattern in the impeller of a centrifugal pump at different partial loads, as based on the theory of centrifugal pumps, and to compare the results of the mathematical analysis with experimental analysis.

A review of the previous literature on the subject showed a difference in the opinions of several investigators about the cause of the spiral motion in the suction pipe. Also, there was no agreement as to the cause of the well established fact that the total energy of the water near the wall of the suction pipe, just before entrance to the impeller, is much higher than at the center of the pipe. The above mentioned factors are discussed in the thesis.

From the experimental measurements and observations, and also from the theoretical analysis, the results obtained may be summarized as follows:

- (1) A spiral motion, in the direction of impeller rotation, existed in the suction pipe for heavy partial loads.
- (2) Reverse flow occurred from the impeller to the suction side of the centrifugal pump at heavy partial loads.
- (3) The pressure, velocity, and total energy of the water just before entrance to the impeller were much higher for heavy partial loads near the suction pipe wall than in the center of the pipe.
- (4) The pressure, velocity, and total energy of the water near the suction pipe wall increased in the direction of flow of water in the suction pipe.
- (5) The increase of the length of the suction pipe suppressed prerotation to some extent, but the variation of the flow pattern, as indicated above, still persisted.
- (6) The theoretical analysis showed that reverse flow in the suction pipe would occur at heavy partial loads.

137 pages. \$2.00. Mic 57-2449

ENGINEERING, HYDRAULIC

INVESTIGATION OF THE FLOW CHARACTERISTICS IN THE SUCTION SIDE OF A CENTRIFUGAL PUMP

(Publication No. 21,752)

Ahmed Mohamed El-Sibaie, Ph.D.
Kansas State College, 1957

The main object of this research work was to investigate the flow mechanism in the suction pipe of a centrifugal pump at various speeds, and for several lengths of the pipe. The study was limited to partial loads on the pump. The pressure and velocity distributions were determined, by traverse measurements, at certain selected sections in the suction pipe. The direction of flow of the fluid was also determined at these sections. Moreover, the existence of both spiral motion and reverse flow in the suction pipe was observed through the use of a dye injection apparatus and a clear plastic pipe connected to the pump suction flange.

ENGINEERING, MECHANICAL

THE GROWTH OF DISTURBANCES IN A FLAME-GENERATED SHEAR REGION

(Publication No. 20,939)

Perry L. Blackshear, Jr., Ph.D.
Case Institute of Technology, 1956

The growth of transverse velocity disturbances in the shear region caused by a flame in a duct is examined theoretically and experimentally.

The theoretical analysis consists of a stability analysis of a flow field arising from a flame in a duct - that is, Scurlock's flow. Scurlock's flow is found to be neutrally stable to symmetric disturbances and unstable to antisymmetric ones.

In following the history of a disturbance of given frequency from the flameholder downstream, it is found that a most-amplified frequency exists, which is related to flow velocity and duct width by

$$\text{frequency} = \frac{\text{inlet velocity}}{\text{duct width}}$$

Frequencies greater or less than this are amplified less than this one.

The amount that an incoming disturbance is amplified depends on the flame slope. For the most-amplified frequency, the ratio of the terminal to initial transverse disturbance velocity is equal to $1.1^{1/2}$ where the slope is roughly turbulent flame speed. This ratio of terminal to flow velocity initial transverse disturbance velocity is dependent on inlet velocity and flame speed only in the stated manner and is essentially independent of density ratio.

The critical wavelength separating disturbances that will grow from those that will not grow varies as $K \times$ flame width, where K is 2 1/2 for flames that are narrow compared with duct width and goes to ∞ as the flame reaches the wall. The flow is unstable to disturbances having wavelengths greater than critical. Thus, short-wavelength (i.e., high-frequency) disturbances achieve their terminal amplifications near the flameholder, while long wavelength disturbances achieve theirs further downstream. The most-amplified disturbance achieves its terminal amplification when the flame fills 0.60 of the duct.

The results are related to measurable quantities in the form of

- (1) Flame-front displacement
- (2) Phase velocity
- (3) To a first approximation, the effect of disturbance frequency on flame propagation velocity

The experimental part of the program consists in imposing disturbances of various frequencies upon a flame stabilized in a duct, and measuring the effects through shadow photography and photomultiplier probe surveys.

The efforts to verify elements of the theory are encouraging but not conclusive. Reasonable agreement is achieved in the comparison of flame-front displacement and phase velocity. In the measurements of the effect of frequency of disturbance on flame speed, there appeared to be a most-effective frequency, just twice the most-amplified frequency given by theory.

There is no direct evidence of transition due to these disturbances. The flow was turbulent in all cases owing to transition in the flameholder boundary layer, either on the flameholder or near the point of separation. There was evidence, however, that the base turbulent flame, wrinkled by the long-wavelength disturbances, was altered (made more turbulent) when the disturbances were present. In other words, the large-amplitude, long-wavelength disturbances cause a sort of transition in the already turbulent flow, amplifying the smaller scale disturbances present.

196 pages. \$2.55. Mic 57-2450

AN INVESTIGATION OF THE RELATIONSHIP BETWEEN THREE-DIMENSIONAL CYCLIC STRAIN AND HEAT GENERATION IN RUBBERLIKE MATERIAL

(Publication No. 21,501)

Francis Sing Tse, Ph.D.
The Ohio State University, 1957

The relation between three-dimensional cyclic strain and hysteresis heat in rubber was investigated to establish a rational basis for relating hysteresis and different types of strain.

This relationship was first derived from tests on elongation and simple shear specimens in which the strains were homogeneous. Hysteresis was measured from force-deformation hysteresis loops. Strain was expressed in terms of strain invariants. Secondly, the derived relationship was verified by a compression specimen in which the strain was non-homogeneous. A composite hysteresis was obtained for the compression specimen. Then, with identical test conditions, the deformation of each small elemental volume of rubber was observed by radiographing the displacements of metallic markers imbedded in the compression specimen. On the assumption that these elemental volumes were under homogeneous strain, the corresponding strain invariants and hysteresis were evaluated. The sum of the hysteresis for all the elemental volumes should equal the composite value.

The strains employed for the elongation, simple shear, and compression specimens were 0.7, 1.5, and 0.4 respectively. The frequency range was from 0.5 to 12.5 c.p.s. The tests were performed at room temperature conditions.

It is postulated that (a) the material is isotropic, (b) the volume change is negligible, and (c) the effects of dynamic modulus and strain on hysteresis are separable. For a given strain, the area of a hysteresis loop is proportional to the dynamic modulus. To separate the effects of modulus and strain, the data are correlated by (a) idealizing the rubber so that the modulus is constant, (b) correlating the idealized hysteresis to strain, and (c) obtaining the actual hysteresis by multiplying the idealized hysteresis by the ratio of the actual to the idealized modulus.

The data show that the idealized hysteresis in ft.-lb./lb.-m can be correlated to strain by the expression

$$H(\omega, I_i) = [132(I_1 - 3) - 47(I_2 - 3)] (\omega/0.55)^{0.112}$$

where ω is the frequency in c.p.s. and I_1 and I_2 are the first and second strain invariants. In the deformation of a unit cube along its three orthogonal axes, if the principal extension ratios (1 + principal strain) are λ_1 , λ_2 and λ_3 , the strain invariants are defined as $(\lambda_1^2 + \lambda_2^2 + \lambda_3^2)$ and $(\lambda_1^2 \lambda_2^2 + \lambda_2^2 \lambda_3^2 + \lambda_3^2 \lambda_1^2)$. The actual hysteresis is obtained by the relation

$$H(\omega, I) = H(\omega, I_i) \times \frac{\text{Actual dynamic modulus}}{\text{Idealized dynamic modulus}}$$

The dynamic moduli in lb./in.² are idealized at infinitesimal strain, the values of which for the elongation, shear, and compression tests are

$$E = 1060 (\omega)^{0.0384}$$

$$G = (1/3) E$$

$$E_c = 1330 (\omega)^{0.0384}$$

The actual moduli for the data range employed are

$$E = (235)(\alpha-1)^{-0.448} (\omega)^{(0.01778)} (\alpha-1)^{-0.238}$$

$$G = [121.5(\gamma)^{-0.368} + 7.4(\gamma)^{2.74}] (\omega)^{(0.0198)} (\gamma)^{-0.238}$$

$$E_c = [590 (\epsilon)^{-0.185} + 4510(\epsilon)^{3.80}] (\omega)^{(0.03)} (\epsilon)^{-0.176}$$

where α , γ , and ϵ are the dynamic elongation ratio (1 + unit elongation), shear, and compressive strains respectively.

Correlations for the elongation and shear tests agree closely with the experimental data. Deviation for the compression tests is on the order of ± 10 per cent.

The results obtained by extrapolating the data to the condition of zero strain are consistent with those deduced from infinitesimal strain tests, namely,

$$\begin{aligned} E &= 3 G \\ \gamma &= \sqrt{3} (\alpha - 1) \\ \eta_\alpha &= 3 \eta_\gamma \end{aligned}$$

where η_α and η_γ are the equivalent viscosity coefficients for the elongation and shear tests normally employed in rubber testing. 282 pages. \$3.65. Mic 57-2451

ENGINEERING, MECHANICS

COUPLED BENDING AND TORSIONAL VIBRATIONS OF THIN-WALLED BARS OF OPEN CROSS SECTION BY APPROXIMATE METHODS

(Publication No. 21,573)

Yu-kweng Michael Lin, Ph.D.
Stanford University, 1957

When the shear center of the cross section of a beam does not coincide with the centroid of the section, bending and torsional vibrations will affect one another. This type of motion is called coupled vibration.

The major part of this thesis is devoted to developing two approximate methods for finding the natural frequencies of coupled vibration. These methods are accurate enough for all practical purposes. Only thin-walled bars of open cross-section are considered.

The Rayleigh-Ritz method is discussed first. Sections with negligible as well as non-negligible warping effect are considered. The second approximate method is based upon a further assumption regarding the mode shapes. Simpler and unified equations are obtained for all boundary conditions. In many cases, results from the second method are even closer to the exact values than those from the Rayleigh-Ritz method. By adjustment of the modifying coefficients, the accuracies can be improved still further. However, such an adjustment is usually not necessary.

Examples for various boundary conditions are presented. Comparisons of numerical results are made in graphical and tabular form for the two approximate methods as well as some available exact values.

In the last chapter, investigations are made for coupled vibrations with disturbing forces. General equations of the transient state for a beam with unspecified boundary conditions are derived. The dynamic magnification factor is determined, and a numerical example is given for the purpose of illustration. 123 pages. \$2.00. Mic 57-2452

ENGINEERING, METALLURGY

EFFECTS OF PHYSICAL VARIABLES ON DELAYED FAILURE IN STEEL

(Publication No. 21,660)

Robert D. Johnson, Ph.D.
Case Institute of Technology, 1956

The effects of three specific variables, hydrogen distribution, test temperature, and prestressing, were determined on the hydrogen-induced brittle fracture of 4340 steel in static fatigue. An electrical resistance method was employed to measure the crack propagation characteristics in hydrogen-charged and aged specimens and in specimens which were prestressed prior to charging.

Crack propagation in aged specimens was sensitive to the hydrogen distribution but relatively independent of the applied stress for a given hydrogen distribution. Internal cracks were observed in aged specimens even in the presence of a sharp external notch. The temperature dependence of the rupture time indicated that the crack propagation was diffusion-controlled both in aged specimens and in specimens with an initial surface concentration of hydrogen. Prestressing prior to electrolytic charging with hydrogen tended to diminish the delayed failure phenomenon by elevating the stress range in which delayed failure occurred.

71 pages. \$2.00. Mic 57-2453

THE SORPTION OF SOME DIATOMIC GASES ON STAINLESS STEEL AND IRON SURFACES AND ITS RELATION TO PASSIVITY

(Publication No. 21,444)

William Parks McKinnell, Jr., Ph.D.
The Ohio State University, 1956

The passivity of stainless steel is believed to result from the formation of a film on the surface of the stainless steel when it is exposed to an oxygen-bearing environment. This work provides additional evidence that this film is an oxide.

Carbon monoxide, nitric oxide, nitrogen, and oxygen were the gases whose sorption characteristics were studied. Type 304 stainless steel and Armco iron foils were the materials investigated. The surface condition of the foils was carefully controlled. Both the stainless steel and iron were pickled in boiling 10 per cent sulfuric acid solution for five minutes. Corrosion products were scrubbed off; then the strips were rinsed twice in double-distilled water and twice in acetone. Immediately upon drying, the specimens were sealed in the sorption apparatus and treated *in situ* in one of the following ways: reduced in an atmosphere of hydrogen at 400° C., outgassed at 400° C., or outgassed at room temperature.

The true surface area of the pickled specimens was determined by the adsorption of carbon monoxide at -183° C. The roughness factors of the reduced specimens were found to be considerably smaller than those of specimens which were outgassed but not heated. In the case of the iron strips, an obvious removal of rust was accomplished by reducing.

Carbon monoxide and nitrogen are not sorbed on any of the pickled surfaces at room temperature. Oxygen and nitric oxide are irreversibly sorbed on both stainless steel and Armco iron at 0°, 30°, and 100° C. The quantities of these gases sorbed on stainless steel are insufficient to form a monolayer. Reduced surfaces sorb smaller quantities than do outgassed surfaces, probably because their roughness factors are smaller.

Reduced iron surfaces take up the equivalent of several layers of oxygen and nitric oxide at room temperature, while the outgassed surfaces sorb much less. This is further indication of the fact that the oxide on iron is reduced by heating in hydrogen.

The rate at which oxygen and nitric oxide are sorbed on stainless steel and iron is a slow one after an initial rapid sorption. The capacity of stainless steel to sorb oxygen is limited. After 24 to 48 hours the stainless steel surfaces appear to become saturated with oxygen. This phenomenon

was not observed in the case of oxygen sorption on Armco iron.

It is postulated that as soon as the pickled stainless steel surface is exposed to the air, it begins a rapid oxidation. Exposing the surface to vacuum halts the growth of the oxide film before it reaches its critical thickness of 30-50 Angstroms. Further exposure to oxygen allows the oxide film to resume thickening. When the critical thickness is reached, no further oxidation can occur.

The passivating effect of NO on stainless steel was examined. Specimens activated by abrading and exposed to 10 per cent sulfuric acid are passivated by bubbling nitric oxide through the solution. Nitrite and nitrate ions were found in the solution after the NO treatment. The addition of one part of 10 per cent nitric acid to 60 parts of ten per cent sulfuric acid also causes passivation of abraded stainless steel specimens.

83 pages. \$2.00. Mic 57-2454

FINE ARTS

BRONZINO STUDIES
[with a book of] **ILLUSTRATIONS**
(Publication No. 20,155)
Craig Hugh Smyth, Ph.D.
Princeton University, 1956

The thesis consists of five studies on Bronzino dealing with problems of attribution, development, and his relation to the history of mannerism.

The first study, published previously, treats Bronzino's first period, extending from the early twenties to about 1527-1528, the sources of his early style, and his initial relation to mannerism while Pontormo's assistant. From the outset his leanings appear different from Pontormo's, and his early work under Pontormo is characterized as artificial early mannerism. The influence of Raffaellino del Garbo, a previous teacher, is pointed out and its contribution to Bronzino's reaction against early mannerism at the close of the period. Other early influences are considered. Two appendices concern the date of Bronzino's apprenticeship to Pontormo and the Garbo-Carli problem.

It has been customary to think of Bronzino as a portrait painter to the neglect of his other work and to minimize his ability as a draftsman and designer. Few drawings are attributed to him, nearly all poor. The second study is on Bronzino's drawings and gives a new catalogue of them built up systematically around those for which his authorship is supported by external evidence as well as style. Many have previously been under other names. The catalogue is not large but represents nearly all parts of Bronzino's career. The drawings show variety and distinction and throw light on his development.

The third study resumes the chronological consideration of Bronzino's career, returning briefly to the first period to put in place there additional material emerging chiefly from the treatment of the drawings.

The fourth study deals with Bronzino's second period as one of independence and mastery extending from 1527-1528 to about 1539 or 1540. It reconstructs the opening phase from 1527-1528 through 1530 as the crucial moment in which Bronzino's creative independence begins. The works of this time show new objectivity and moderation, and more architectonic compositions in reaction to early mannerism. Two portraits are included here as the first examples of Bronzino's portraiture. They place the beginning of his individual portrait style earlier than was thought and emphasize his importance in the development of the reserved mannerist portrait. New influences are considered, including Michelangelo's. An inquiry into Bronzino's work at Pesaro from 1530 to 1531-32 follows. It emerges that Bronzino's share in decorating the Villa Imperiale was considerable, with the result that his beginnings as a decorative painter can be studied. New influences from both northern Italy and Rome mark the Pesaro phase. Bronzino's scope is broadened, his anti-quizing begins, and the figure styles of his later work are

adumbrated. The study concludes with the masterful years from 1532 to about 1539 or 1540, which climax the second period. It is shown how towards the end of the thirties Bronzino entered upon a new stage of mannerism, here called later mannerism or sixteenth-century mannerism proper, which dominated his work thereafter.

The fifth study begins with an essay on later mannerism, defining the nature of the style which began, as put forward here, in the middle thirties and subsequently blanketed most of Italian painting. It is then proposed that, whereas from the end of the thirties on Bronzino's work belonged to the later-mannerist style, his second period represents an interim phase of mannerism, one of moderation distinct both from early mannerism, which reached its height in the twenties, and from later mannerism.

An appendix gives a document dating two of Bronzino's earliest tapestries and evidence against the usual assumption that he was in Rome from 1546 to 1548.

397 pages. \$5.10. Mic 57-2455

**THE SIGNIFICANCE OF THOMAS MORAN
AS AN AMERICAN LANDSCAPE PAINTER
(VOLUMES I AND II)**
(Publication No. 15,897)

James Benjamin Wilson, Ph.D.
The Ohio State University, 1955

While the portrait and other forms of painting had become popular much earlier, landscape painting in America was neglected before the nineteenth century. At this time civilization in America had progressed to the point where a more subjective attitude toward landscape could be adopted. Through the nineteenth century a number of painters began to produce landscapes reflecting their own personal style and representing various schools or sections of the country. The present study undertakes an investigation of one of the more prominent American landscape painters, Thomas Moran, emphasizing the sources of his style, the character of his work, his life and personality, and, finally, his influence upon American landscape painting.

Although born in Bolton, England, Moran came to America at the age of seven and settled with his family in Philadelphia, where an elder brother, Edward, maintained a studio and specialized in marine paintings. Two younger brothers, John and Peter, were also painters. In addition, Thomas Moran's wife, Mary Nimmo Moran, became one of America's foremost etchers of the late nineteenth century. Early in his career Moran made two trips to England, in 1861 with his brother Edward and in 1862 with his wife, where he became fascinated with the work of the English painter William Turner. Under his influence, Moran developed a pronounced interest in problems of light,

color, and atmosphere and produced a series of Turner-esque Venetian scenes that earned him the title of "The Turner of America."

Perhaps Moran would have continued to paint in the manner of Turner and others whom he admired had not an event occurred in 1871 which was to influence his style for the remainder of his career. Scribner's Monthly Magazine, looking for an artist to illustrate an article on the American West, offered the commission to Moran. An arrangement was made whereby he accompanied Dr. Ferdinand V. Hayden, a geologist, on an official government expedition to explore the region now known as Yellowstone National Park. This was the first of a series of western trips which lasted throughout the remainder of the artist's life. He became so enchanted with the spectacular scenery that painting it became almost his whole career.

Moran is characterized by versatility in all aspects of his career. He explored subjects in the same way he explored techniques, and with admirable flexibility was able to vary his technique in accordance with the area in which he painted. He maintained a New York studio during most of his life and commuted to his home in East Hampton, Long Island. This provided him with a quiet, calm land-

scape in startling contrast to his large, dramatic panoramic scenes of the west. Mexico offered Moran a type of scenery not found at home, and he produced a series of Mexican landscapes which differ in style and concept from his other works. His versatility in the handling of various media besides oil painting can be seen in his numerous drawings, watercolors, engravings, woodcuts, and etchings. In fact, in 1884 the famous English critic John Ruskin described Moran's etching as "the best etching yet to come out of America."

Moran thought of himself as an independent artist, consciously refraining from associating himself with existing schools of painting such as the Hudson River artists. But he was more a product of his time than either he or his contemporaries would have us believe, and there is evidence in his work to prove that he painted in accordance with his time and is not too far removed from American landscape painters such as Frederick Church, George Inness, or Thomas Cole. Too, Moran had a great admiration for other European painters besides Turner, and his work reflects something of the Barbizon painters Camille Carot, Théodore Rousseau, and Charles-François Daubigny.

314 pages. \$4.05. Mic 57-2456

GEOGRAPHY

THE LOWER PAPALOAPAN BASIN: LAND AND PEOPLE

(Publication No. 17,559)

William W. Winnie, Jr., Ph.D.
The University of Florida, 1956

The Lower Papaloapan Basin is a tropical lowland area on the Gulf Coastal Plain of Mexico south of the city of Veracruz. Like most tropical areas of similar size, it embraces several types of physical environment. To say that its lands are good, bad or indifferent is to oversimplify the problem. Some of its soils are rich, others are poor: most lie somewhere between the two extremes.

The 1950 population of 308,000 was as large in terms of land area as that of Mexico as a whole. Most of the people, however, are concentrated along the major streams and around the base of the Tuxtla mountains. The interfluvial areas in most places are sparsely settled.

Two-thirds of the people live in rural areas. The remainder are about equally divided between urban and "semi-urban" centers. Due to high birth and death rates, the population has an unusually large proportion of young people, even for Mexico. Over three-fourths of the economically active people are agriculturists except in the municipios with urban centers, where more than half of them are farmers. Of the people working in agriculture, possibly one-half are both farm operators and farm laborers, the other half being about equally divided between those who are primarily farm operators and those who are primarily farm laborers.

The land systems represent a fusion of Indian and Spanish practices, modified by the agrarian reform program,

which superimposed a rationalized system of land tenure involving collective ownership but private usufruct of cropland. A form of settlement closely approaching the fourth conceptually possible type, in which the farmers' houses would be removed both from each other and from the land worked by their occupants, is the most common one in a large part of the area. It may have emerged when the hacienda system was superimposed on the collective system of land tenure of the Indians.

From the sixteenth through the nineteenth centuries, most of the land of the Lower Papaloapan Basin was controlled by a few powerful owners. Most rural people had access to land only through the colono system, under which they were allowed to raise tiny patches of subsistence crops on the lands of the large estates. As a result of the agrarian reform program, approximately one-fourth of the land of the Lower Papaloapan Basin was, between 1935 and 1950, granted in ejidos to about two-fifths of the heads of families in the area.

Agricultural technology is generally rudimentary. Fire agriculture is still predominant in much of the area. In places, rudimentary plow culture has been superimposed. Mechanized agriculture is practiced on relatively few farms.

Traditionally, in most parts of the area, the owners of large estates have been cattlemen. In many cases, prestige has been as important as profit as a motive for land ownership. Commercial agriculture appeared before the twentieth century in only a few favored areas. The principal commercial crops today are sugar cane, pineapples, rice, and bananas, all grown in highly specialized regions. The increased commercialization of the traditional subsistence crops is one of the most important trends in the

economy of the Lower Papaloapan Basin. This development is associated with the landholding communities formed by the agrarian reform and with the growth of a rural middle class.

The generally low levels of living and poor health conditions of the area are more the result of social and cultural than of physical factors. There seem to be no insur-

mountable obstacles to the development of such tropical lowland areas as the Lower Papaloapan Basin, but (1) new combinations of farming techniques must be evolved for use in those areas and (2) governmental agencies will probably have to take an active part in the control of disease.

389 pages. \$5.00. Mic 57-2457

GEOLOGY

GEOLOGICAL RECONNAISSANCE OF CIENEGA GAP, PIMA COUNTY, ARIZONA

(Publication No. 21,511)

Daniel Joseph Brennan, Ph.D.
University of Arizona, 1957

A new formation, the Pantano, of probable lower Miocene age is present. The Pantano formation consists of 13,762 feet of conglomerate, sandstone, and mudstone, with three andesite flows intercalated with the sediments. The presence of this extensive basin-fill deposit indicates that Basin-Range type structures were present in this part of Arizona as early as lower Miocene.

The Pantano formation has regional dip to the east, and is overlain by thrust block of older rocks and by younger sediments.

A simple thrust block of Precambrian granodiorite, with Bolsa quartzite deposited on it, is present in the east north central portion of the area. A large, complexly faulted fault block of undifferentiated Carboniferous rocks lies to the west.

In the central and south-central parts of the area there are imbricate thrust blocks of Bisbee(?) formation, quartz monzonite, and gneiss, lying over the Pantano. There was some minor alteration and mineralization along fault planes.

Presence of thrust sheets on the Pantano indicates the last major disturbance in this region occurred after lower Miocene.

Late Tertiary and Quaternary deposits were not affected by the faulting. The area is now being actively eroded.

97 pages. \$2.00. Mic 57-2458

MINERALOGY AND PETROLOGY OF THE NEW IDRIA DISTRICT, CALIFORNIA

(Publication No. 21,566)

Robert Griffin Coleman, Ph.D.
Stanford University, 1957

The New Idria district located in the southern extension of the Diablo Range, San Benito County, California has been investigated in detail, and a geological map at approximately 1 mile = 1 inch has been prepared. The rock complex studied is an elongated serpentine dome forming the core of a breached anticline flanked by Jurassic and Cre-

taceous sediments. Metasomatism of the serpentine produced small bodies of calc-silicates and titano-silicates of unique mineral assemblage. Dynamothermal metamorphism of the Franciscan formation generated a complex suite of calcic and sodic minerals. Petrologic studies show that the dynamothermal metamorphism of the Franciscan rocks is earlier and distinct from the later metamorphism of the serpentine.

Chemical analyses and optical studies were completed on nine of the uncommon minerals from this complex and optical constants were established on many of the more common rock-forming minerals. The mineralogical studies show that titanium enters the andradite structure (up to 11% TiO_2) producing a concomitant expansion of its cell edge; furthermore idocrase admits up to 5% TiO_2 with corresponding changes in optical constants and unit cell dimensions. The white jadeite from the Franciscan schists is almost pure $NaAlSi_2O_6$ and contains less than 3% of the diopside and acmite molecules. The reddish-brown barkevikite, an essential constituent of the intrusive rocks, contains abnormally low (OH) for amphiboles. The wide variation in the optical constants of glaucophane and grossite indicates anomalous substitution in these amphibole structures. Metasomatic alteration of the serpentine has produced chlorites enriched in Al and Fe, as determined by the optical variation of these minerals. Alteration of chromite during serpentinization has produced the rare chromium chlorite, kämmererite.

The rock units of the complex are divided into seven types: (1) Franciscan formation of Jurassic age, (2) serpentine, (3) Panoche formation of upper Cretaceous age, (4) younger Cretaceous and Tertiary sediments, (5) syenite and camptonite, (6) metasomatic rocks, and (7) superficial deposits. The Franciscan greywackes, cherts, and basic igneous rocks have undergone dynamothermal metamorphism similar to that found in the greenschist facies. Large tectonic inclusions of metamorphosed Franciscan within the serpentine contain jadeite which is considered to have formed during the late stages of metamorphism. The large serpentine dome, almost completely serpentinized to chrysotile and antigorite, has been emplaced by tectonic movements. The Franciscan, Panoche, and younger sediments that flank the serpentine dome are sheared and faulted along their respective contacts and this appears to be indicative of continued tectonic activity during Cretaceous and Tertiary times.

Intruding the serpentine are small dikes and plugs of syenite and camptonite; the latter represents an early stage of intrusion which was followed by the syenite. These

rocks contain up to 40% barkevikite with feldspar that ranges in composition from andesine, in the early stages, to albite during the later syenite crystallization. Progressive loss of Ca, Mg, Fe and Ti and enrichment in Na and Al suggests considerable migration of fluids from the intrusive rock during emplacement. It is shown that fluids from these intrusions have produced metasomatized zones --calc-silicates, chlorite, and barium titano-silicates-- within the serpentine and to a lesser degree formed veins in the tectonic inclusions. The calc-silicate bodies contain diopside, idocrase, chlorite, and titanian andradite. In addition to the essential mineral the chlorite bodies contain titanian andradite, perovskite, sphene, and ilmenite. Barium titano-silicate metasomatism is restricted to the tectonic inclusions where natrolite - sodic-amphibole veins contain the rare minerals benitoite, joaquinite, and nephrite.

Forty-three semi-quantitative spectrographic analyses of the described rocks and minerals demonstrate that metasomatism of the serpentine was accomplished by fluids arising from the syenite and camptonite intrusions. Nb, Zr, rare-earths, Sn, and Mo were common to minerals from the metasomatic rocks as well as those from the intrusion; these data suggest consanguineous relationships.

191 pages. \$2.50. Mic 57-2459

THE GLACIAL GEOLOGY OF LOGAN AND SHELBY COUNTIES, OHIO

(Publication No. 20,679)

Jane L. Forsyth, Ph.D.
The Ohio State University, 1956

Miami and Logan Counties lie in west-central Ohio. The bedrock in these counties is mostly Silurian dolomite, but an outlier of Devonian limestone and shale in eastern Logan County forms an upland which divided the advancing glaciers into the Miami (western) and Scioto (eastern) lobes. This dissertation describes the glacial deposits of the area in detail and then attempts to correlate them, thus reconstructing the glacial history.

Correlation of end moraines was accomplished by field tracing of hummocky belts of thicker drift and of crests-lines. Outwash relationships were inferred from their mutual field relations and the local stratigraphy. Age of deposits was determined from stratigraphic relations, modern surface soils, buried soils, and radiocarbon datings. Fifteen examples of buried soils occur, mostly along the upper contacts of gravel beneath till. These look like truncated modern Fox soils. A buried soil at the Sidney cut, produced in till, is remarkably well developed. Radiocarbon determinations date the till above the buried soil in the Sidney cut at $23,000 \pm 800$ years (W-188), till from nearby upper Brush Creek at $22,000 \pm 1000$ years, (W-414), and peat from Brush Creek at $>37,000$ years (W-415). These values seem to date both "Early" and "Late" Wisconsin ice advances.

Pre-Wisconsin drift has not been identified in Logan and Shelby Counties, although it is probably present at depth in some places.

"Early" Wisconsin end moraines are identified only in southern Logan County. Here three recessional stages are

outlined by the Inner Upland (oldest), West Liberty, and Farmersville moraines. At several stages during the formation of these moraines, outwash gravels were deposited on line with and above the present Mad River valley. Best-developed of these is the Kennard outwash, which originates at the West Liberty moraine. All three moraines are composed partly of kames, suggesting stagnation of the ice. During formation of the Farmersville moraine, gravel was simultaneously being deposited in an esker just north of the moraine, an outwash plain sloping southward, and kames along the ice edge; buried Fox-like soils identify these deposits as "Early" Wisconsin.

After an ice-free interval characterized by soil formation, the ice readvanced, removing some of the soil just formed and covering all the earlier features with "Late" Wisconsin till. Gravel accumulated as kame terraces on the upland and as valley trains elsewhere in southwestern Logan County. Best-developed of these deposits is the Mad River valley train.

Continued recession produced a series of end moraines whose correlation is somewhat uncertain owing to overlapping relationships probably produced by bedrock "high's," now drift-covered. The first well-identified ice stand is marked by the Powell moraine, which can be traced westward from Union County across the outlier into Shelby County. Here it overrides the moraine named here the Sidney moraine and, farther west, is overridden by the Mississinewa moraine. The western correlative of the Powell is not known, although two moraines in southwestern Shelby County, the Bloomer (named herein) and Union moraines, also appear to date from the same interval.

Glacial Indian Lake developed south of a short well-developed moraine, here named the Beehive, which appears to be younger than the Powell, but older than the Mississinewa.

The next clear-cut ice stand is marked by the St. Johns moraine. Between the St. Johns and Powell moraines are the Mississinewa moraine in Shelby County and the Broadway moraine in eastern Logan County. Regardless of whether these two moraines formed simultaneously, they date from the same interval. An older, poorly-developed moraine north of the Broadway, named here the Bokes Creek moraine, can be followed eastward into Union County and south beneath the Broadway; its relationship with the Powell is not known. The St. Johns moraine to the north may be traced almost without question from east to west.

236 pages. \$3.05. Mic 57-2460

MINERALOGY OF BASIC CARBONATE MINERALS OF COPPER AND ZINC

(Publication No. 21,581)

Yoshihiko Shimazaki, Ph.D.
Stanford University, 1957

A systematic mineralogical study of a varied suite of dominantly copper-bearing minerals from Chuquicamata and Atacama Province, Chile, has been carried out.

The physical properties of the following minerals have been described in detail: chalcocite, azurite, antlerite, natrochalcite, chalcanthite, kroehnkite and chalcophyllite. For natrochalcite and chalcophyllite, new x-ray powder

diffraction data have been recorded and previous x-ray diffraction data have been corrected for the rest of the minerals encountered in this study.

In the course of this study, rosasite, $(\text{Cu}, \text{Zn})_2(\text{OH})_2\text{CO}_3$, was identified in a specimen from Atacama Province. This is the first occurrence of the mineral in this area, and since this basic carbonate presents many interesting problems, the second half of this work is a detailed mineralogical study of rosasite and its related minerals, namely malachite, paraurichalcite, cuprozincite, aurichalcite and hydrozincite.

A specimen of malachite and rosasite and three specimens of aurichalcite were chemically analyzed. One aurichalcite specimen was found to have lower copper content than any yet recorded.

Unit cell dimensions for rosasite, paraurichalcite and cuprozincite were determined from x-ray powder photographs with almost identical results of $a_0 \approx 9.3$, $b_0 \approx 12.1$, $c_0 \approx 3.4$ Å, $\beta \approx 94^\circ$. Unit cell dimensions and space group for aurichalcite were determined from x-ray rotation, Weissenberg and powder photographs with the following results: $a_0 = 6.45$, $b_0 = 13.60$, $c_0 = 5.27$ Å, space group = Pmma. Powder photographs of malachite and hydrozincite have been studied and compared with those of rosasite and aurichalcite.

Rosasite, paraurichalcite and cuprozincite were proved to have identical structures and physical properties and their chemical relationships are that of replacement of copper by zinc or vice versa, with the copper to zinc ratios ranging from 9:2 to 3:2. Furthermore, it is shown in this work that rosasite and malachite have closely related monoclinic structures and the name zincian malachite has been suggested for the former, eliminating the name rosasite. The structural difference between aurichalcite and hydrozincite has been confirmed and the two minerals cannot be considered as forming an isomorphous series.

It is concluded that the basic carbonates of copper and zinc seem to be best considered as belonging to three groups: malachite, aurichalcite and hydrozincite.

93 pages. \$2.00. Mic 57-2461

GRAVITY INVESTIGATION OF THE SOUTHERN SAN FRANCISCO BAY AREA, CALIFORNIA

(Publication No. 21,584)

Samuel Guy Taylor, Jr., Ph.D.
Stanford University, 1957

The southern San Francisco Bay area extends from San Jose northwest to Redwood City. The area includes part of the northern Santa Clara Valley and the foothills of the bordering Diablo and Santa Cruz Ranges.

The areal relationship of exposed Jurassic, Cretaceous, and Tertiary rocks in the foothills indicates the major structure to be a pattern of northwest-trending strike-slip faults. In the northern Santa Clara Valley and its margins previous investigators have been unable to determine the underlying structure because the older rocks are masked by Plio-Pleistocene sediments and younger alluvial deposits. The gravity investigation leading to this thesis was planned to determine the structure of this area. Prominent structural features have been recognized as a result of the gravity measurements.

The rocks of the area fall into three density groups. Density determinations show that the Franciscan rocks have an average density of 2.67 gm/cc, the rocks of Cretaceous and Tertiary age an average density of 2.41 gm/cc, and the recent alluvium an average density of 1.90 gm/cc. Geologic structure affecting the spatial distribution of any of these density groups will result in measurable variations in gravity.

Gravity observations were made along a series of east-west traverses extending from the foothills on one side of the valley to the foothills on the other side. Gravity profiles were drawn by plotting the reduced gravity values, and a Bouguer gravity map of the area was made. The measured variations of the gravity field are unusually large. Many of the anomalies exceed 35 milligals.

The gravity data indicate the presence of previously unknown northwest-trending fault blocks which have apparent vertical displacements of thousands of feet. The faults which separate these blocks were traced into the foothills where they were confirmed by surface evidence.

The significance of the structure determined by this investigation is that it provides the key to the geologic structure in this region from the Pacific Ocean to the Diablo Range. By fitting this link into the geologic cross-section it appears that the large strike-slip faults must have had considerable vertical displacement in the geologic past and that the region has a block-faulted structure similar to that of the Basin and Range Province.

159 pages. 2.10. Mic 57-2462

HEALTH SCIENCES

HEALTH SCIENCES, GENERAL

EXPERIMENTAL SURGERY OF THE HEART AND GREAT VESSELS UNDER HYPOTHERMIA

(Publication No. 20,546)

Norman E. Shumway, Jr., Ph.D.
University of Minnesota, 1956

The thesis of using hypothermia to perform surgery on the bloodless heart is well established physiologically and clinically. Decreased metabolism by such important organs as the brain and central nervous system, liver, and kidneys permits 6 to 10 minutes of circulatory arrest at 28-30 degrees C. Convincing evidence is at hand to suggest that non-hibernating animals can withstand 20 to 30 minutes of cardiac occlusion at 20-25 degrees C. The bête noir of hypothermia is ventricular fibrillation, the cause of which has not been delineated. Coronary blood flow during hypothermia is adequate, but a certain propensity for the development of ventricular fibrillation can be neither denied nor prevented.

Experimental surgery on the mitral valve performed under direct vision on dogs indicates that suture diminution of the mitral orifice can be accomplished only if stitches are taken deep in annular tissue because normal leaflets are easily torn by sutures under tension. Excavation of the posterior rim of the mitral valve to gain mobility is ineffective and so also is the suspension of atrial flaps through the valve.

Ventricular septal defects in dogs are readily repaired by suture methods under direct vision and hypothermia induced by ice water immersion. Exposure of the ventricular septum through the left ventricle is well tolerated if the papillary muscles are not injured. Possible indications for the left ventriculotomy approach include instances of previous right ventriculotomy and patients with severe pulmonary hypertension where integrity of the right ventricle is critical.

Open surgery on the aortic valve under hypothermia is feasible. The danger of coronary air embolism can be averted by allowing the heart to fill with blood completely before clamping the aortic incision and removing aortic occlusion distal to the aortotomy. Contractions of the heart with the aortic valve exposed to ambient conditions do not predispose to coronary air embolism.

Aortic septal defects made in dogs by suture methods can be closed under inflow occlusion with hypothermia through an incision in the pulmonary artery. Although comprising only 1 per cent of all congenital cardiac anomalies, aortic septal defects will be encountered more frequently as intracardiac surgery progresses.

Polyvinyl sponge, Ivalon, is an ideal material for making prosthetic arteries. Polyvinyl sponge grafts inserted in the thoracic aorta of dogs during hypothermia neither deteriorate nor contract over periods of time up to 2 1/2 years. Polyvinyl sponge is an extremely valuable plastic

because of the ease with which it can be molded into any shape.

Coronary perfusion even with blood containing venous levels of oxygen saturation can prolong the period of safe cardiac occlusion at 25 degrees C. to 20 minutes. The cold heart has a remarkable ability to extract oxygen from coronary blood. Flows of 50 ml. per minute are adequate. The incidence of ventricular fibrillation is decreased by coronary perfusion during hypothermia but not abolished.

Induced ventricular fibrillation for experimental intracardiac surgery under hypothermia has the theoretical advantage of providing a quiet heart free from the hazard of coronary air embolism. Unfortunately the retrieve by defibrillation is never 100 per cent although the cold heart offers no special problem for defibrillation by electric shock. A well oxygenated myocardium seldom resists countershock. Epinephrine, massage, and an electric shock of sufficient current provide a technique for the conversion of ventricular fibrillation as suitable in hypothermic hearts as in hearts at normal temperature. Clinical use of intentional ventricular fibrillation is not sanctioned.

98 pages. \$2.00. Mic 57-2463

HEALTH SCIENCES, PHARMACY

THE EFFECT OF ANTIOXIDANTS ON THE STABILITY OF ASCORBIC ACID AND CYANOCOBALAMIN SOLUTIONS

(Publication No. 21,524)

Theodore Spiros Kallelis, Ph.D.
University of Maryland, 1957

Supervisor: Professor Noel E. Foss

Up to the present time, information on the effect of antioxidants on ascorbic acid or cyanocobalamin in liquid formulations has not appeared in literature. In this laboratory, research has already been carried out on (1) the effect of certain vehicles on the stability of ascorbic acid and cyanocobalamin and (2) the effect of certain trace metals on the stability of ascorbic acid and cyanocobalamin solutions.

This investigation was conducted to ascertain the effect of certain antioxidants on the stability of (1) ascorbic acid, (2) cyanocobalamin and (3) ascorbic acid-cyanocobalamin combinations in certain types of liquid formulations. The following liquid formulations were employed: (1) distilled water redistilled in an all glass apparatus, (2) aqueous solutions buffered to pH 6.0, (3) syrup and (4) citric acid syrup. The antioxidants employed were sodium bisulfite, potassium cyanide, thiourea, glycine, thioglycerol,

glutathione, thiadipropionic acid, sustane (butyl hydroxyanisole), melilotin (dihydrobenzopyrone), NDGA (nordihydroguaiaretic acid), ethyl hydrocaffeate, sequestrene Na 2 (disodium ethylenediamine tetraacetate), and sequestrene Na 3 (trisodium ethylenediamine tetraacetate).

Preliminary study was carried out on the determination of cyanocobalamin using columns of ion-exchange resins. All solutions were placed in screw cap, flint glass bottles and stored at room temperature or at 42°C. In every instance the concentration of the ascorbic acid was 25 mg./ml. while for the cyanocobalamin it was 20 mcg./ml.

The ascorbic acid was assayed by the iodimetric method. In all instances blanks containing all the ingredients except ascorbic acid were assayed to determine if the antioxidants had any effect on the titrant.

From the experimental evidence, the following conclusions were postulated:

1. The antioxidants have a stabilizing effect on ascorbic acid in aqueous solutions.

2. The addition of sugars to ascorbic acid solutions enhances the stability of the preparations.
3. The stability of ascorbic acid in solutions containing sugar is further increased in the presence of antioxidants.
4. The stability of cyanocobalamin solutions is influenced by pH, antioxidants and the type of vehicle.
5. The antioxidants have a deleterious effect on cyanocobalamin in distilled water.
6. It is possible to increase the stability of ascorbic acid-cyanocobalamin in liquid formulations by (a) controlling the pH from 5 to 7, (b) using a vehicle composed of a syrup and (c) including an antioxidant such as sodium bisulfite, potassium cyanide and the sequestrenes in concentrations of 0.025 to 0.1 per cent.

55 pages. \$2.00. Mic 57-2464

HISTORY

HISTORY, GENERAL

THE REVOLUTIONARY CAREER OF SILAS DEANE

(Publication No. 21,065)

Coy Hilton James, Ph.D.
Michigan State University, 1956

The reputation of Silas Deane, America's first diplomat, has been tarnished. Although he was charged with treason and various other unsavory transactions, his personal contribution went a long way toward determining the outcome of the struggle for independence. All concede him this place yet he paid a heavy price for his devotion to the Revolutionary cause. His success aroused envy and earned the hatred of some narrow-minded men who permitted vindictiveness and personal jealousies to blind a normal sense of decency.

From the beginning of the struggle with England Deane was a prominent figure. In the legislature of Connecticut and the Continental Congress he stood out as a champion of colonial rights and later accepted a mission to France without hesitation. Arriving in France in July of 1776 without friends, influence, or funds, he secured supplies which enabled the American forces to win the battle of Saratoga. In December of 1776 Benjamin Franklin and Arthur Lee joined him in a Commission to negotiate a treaty with France. This was accomplished just before Deane was recalled by Congress to report on American affairs in Europe.

Deane's recall marked a turning point in his Revolutionary career. Instead of a report, Congress demanded a financial accounting for which Deane was not prepared. From France Arthur Lee accused Deane of malfeasance of office. In the war of words that followed Congress postponed a final decision by discharging Deane. He returned to France under the impression that an auditor would be appointed to settle his accounts.

When Deane returned to France for the second time his primary purpose was to re-coup his personal finances. Unfortunately his commercial enterprises failed and Congress refused to appoint an auditor to settle his accounts. Disgusted with Congress and disappointed by French apathy, Deane wrote a number of critical letters to America. Some of these letters were intercepted and published in the Tory press. At first they were assumed to be forgeries, but Deane later admitted writing them, and his enemies charged treason. The public accepted the charge.

When the war ended Deane went to England where he hoped to secure capital to re-enter trade. His enemies accused him of associating with Benedict Arnold and other pro-British Americans and held him responsible for the unpopular commercial clauses of the Treaty of 1783. During the years that Deane lived in England only the generosity of his friends saved him from dire poverty and from becoming an object of charity. After suffering many disappointments and worn out in body and mind, Deane decided to return to the United States. He sailed for America in 1789 but died some four hours out of port. The ship returned and Deane was buried in England.

Deane's death, like the last decade of his life, was of little interest to the people of America. Today Silas Deane sleeps in an unknown grave in England, but in 1842 Congress admitted that a former audit was "ex parte, erroneous, and a gross injustice to Silas Deane." Restitution was made to his heirs, a restitution which should have restored in some measure the reputation of Silas Deane. This it failed to do. The present work, therefore, is an attempt to place the career of Silas Deane in its proper perspective. Deane undoubtedly was indiscreet at times and made serious mistakes, but on the basis of the evidence now available, it would not appear that he was guilty of committing treason.

295 pages. \$3.80. Mic 57-2465

A STUDY OF THE BRAZILIAN IRON AND STEEL INDUSTRY AND ITS ASSOCIATED RESOURCES

(Publication No. 21,578)

Edward Jonathan Rogers, Ph.D.
Stanford University, 1957

With the exception of coal, Brazil has excellent resources on which to base an iron and steel industry. The nation is said to contain approximately 22 per cent of the world's known iron ore. Several Brazilian states contain iron ore but the largest deposits are found in the states of Mato Grosso and Minas Gerais. Associated with these iron ore deposits are significant beds of manganese located in Mato Grosso, Minas Gerais and the Territory of Amapá.

It is the hematite ore of Minas Gerais, however, that has intrigued the nation and the outside world. Large deposits of high-grade hematite ranging from the hard, compact variety through the soft powdery jacutinga type are available. Even more abundant is the low-grade ore which consists mainly of canga, a blanket of hydrated, conglomerate ore, and itaberite, the principal constituent of the Minas Gerais iron formation. Exports of Minas Gerais ore are made by the government-owned Rio Doce Valley Company via the port of Vitória. Iron ore exports from this port have risen from 45,000 tons in 1940 to 1,500,000 tons in 1952.

Brazil has only medium supplies of low quality coal. The coal seams are thin and interlaced with clay, shale and pyrite. They are also high in phosphorus content. Unfortunately, these coal fields are located in southern Brazil--over 600 miles from the iron ore deposits. To date, only coal found in Santa Catarina has the coking qualities needed for iron ore smelting. The Brazilian Government has steadily advanced coal production from 300,000 tons in 1935 to over 2,000,000 tons in 1953. Present governmental plans call for a yearly output of 3,000,000 tons by 1960.

The roots of the Brazilian iron and steel industry reach back to the iron-working activities of the Jesuits in the middle of the sixteenth century. However, it was not until the early nineteenth century that smelting enterprises beyond the primitive Catalan forge were founded. During the nineteenth century, the Portuguese Crown, exiled to its Brazilian colony by Napoleon, took the lead in founding numerous blast furnaces.

Brazil's modern iron and steel industry dates from the establishment of the Esperança ironworks in 1891. This plant, virtually alone, furnished Brazil with pig iron before and during World War I. The 1920's saw the rise of a number of mills which are still in production today. Among these is the Belgo-Mineira Company--Brazil's second largest iron and steel producer. The depression and the nationalism of the 1930's combined to create in Brazil the needed climate for further growth in iron and steel. Several important mills were established and these, added to those enterprises already in operation, raised pig iron production from 35,000 tons in 1930 to over 200,000 tons in 1940.

The war years and the post-war boom of the 1940's witnessed spectacular growth in iron and steel output. Many new enterprises were founded and older ones were expanded. The greatest event during this period was the construction of the coke-based National Steel Company at

Volta Redonda. This single mill doubled Brazil's output of iron and steel. It is still the single largest iron and steel producer in all of Latin America. Brazil's steel output rose from approximately 200,000 tons in 1940 to over 1,300,000 tons in 1954. Current iron and steel production is concentrated in the triangle formed by the states of Rio de Janeiro, São Paulo and Minas Gerais. Rio de Janeiro, by virtue of Volta Redonda's output, leads the production field. Present plans, already partially realized, are designed to lift steel production to 2,300,000 tons by 1960.

460 pages. \$5.85. Mic 57-2466

HISTORY, MODERN

THE SAINT-SIMONIANS AND THE FOUNDATION OF THE PARIS-LYON RAILROAD, 1832-52

(Publication No. 21,076)

Robert Bruce Carlisle, Ph.D.
Cornell University, 1957

The specifically Saint-Simonian contribution to French railway development was the proposition that a plan should govern the achievement of a national railway network. The foundation of the Paris-Lyon railroad represented one of several attempts by Saint-Simonians to translate their plan into action. The application of the plan gave rise to a series of oppositions between advocates of considered and of haphazard construction of the railways; between progressive and conservative members of the French business community; and between national and local interests. These elements in the history of the Paris-Lyon railroad recapitulated the early French railway experience which, itself, opened alternative and conflicting routes to French economic development in the nineteenth century.

The documentation for a study of the Paris-Lyon is to be found in the Fonds Enfantin of the Bibliothèque de l'Ar-senal and in the series F 14 of the French National Ar-chives. The Archives of the Department of the Rhône and the municipal archives of Lyon have also been utilised.

The first expression of the need for a railway line from Paris to Lyon is to be found in the articles written for the Saint-Simonian Globe by Michel Chevalier in 1832. Chevalier drew his inspiration from the appeals to the in-dustrialists, financiers and engineers made by Saint-Simon and widely publicised by Prosper Enfantin. Chevalier pro-posed that a Mediterranean system of communications should be created under the aegis of France. Such a sys-tem would serve as the base for an industrial development which would enable France to rival both the wealth and the international position of England. At one end of the Medi-terranean there would be a Suez Canal, at the other a railroad from the Channel to the Mediterranean which could exact toll on British goods crossing France by way of Paris and Lyon.

These propositions were popularized in the press, the administration and the chambers by the Saint-Simonians between 1832 and 1842. The Saint-Simonian principles of co-operation, industrialization and planning were em-bodied in the railway law of 1842 as was provision for the

line from Paris to Lyon. Following passage of the law, the Lyonnais Saint-Simonian, Arlès-Dufour, participated in the formation of a company to gain the concession of the line.

When the Lyonnais group proved unsuccessful the aid of the former Saint-Simonian leader, Prosper Enfantin, was enlisted. In collaboration with his friends the Pereires, the Talabots and Arlès-Dufour, Enfantin was successful in attracting the support of the Baron James de Rothschild for the organization of a railroad cartel which gained the concession for the Paris-Lyon in 1845.

In the construction of the road the Saint-Simonian unanimity of purpose broke down. The Saint-Simonian theorists-Enfantin, Talabot, Jullien-consistently opposed competitive bidding for rails contracts, justifying their stand as contributing to the health and expansion of the major French forges. The Pereires, although demanding material of superior quality, opposed Enfantin's policy which so weakened the Paris-Lyon that it was not able to withstand the crisis attendant on the Revolution of 1848. The line passed into the hands of the Republic in the summer of that year.

An additional impediment to the founding of the road had been the impassioned battle between local and national interests centering on the location of the stations at Paris and Lyon. The Saint-Simonian founders of the Paris-Lyon had envisioned the line as merely one link in the Mediterranean system and had hoped to share a single station with the Avignon-Lyon at Lyon. Such a solution endangered Lyon's position as a stopping place in France's North-South trade. The Lyonnais wished to impose three stations on the railroads which would ensure the city's trading position, and open the city to the lines of the Loire and Center of France. The latter lines consolidated, would have been in competition with the Burgundy line.

This plan was that of Bartholony, President of the Orléans line, who also hoped to impose the use of his company's station at Paris on the Paris-Lyon. In the first instance the Lyonnais and the Bourbonnais were successful in gaining separate stations at Lyon. At Paris the Burgundy line was successful in gaining a separate station for itself.

The quarrel between through lines and local lines, between Lyon's interest and France's interest, persisted under the Second Republic. The Pereires attempted to found a single Paris-Avignon line to be financed by novel methods. They were unsuccessful, because they were opposed by the Talabots, Enfantin, the city of Lyon and the industrialists of the Loire. They did, however, enjoy the support of the President and, following the Coup d'Etat, were instrumental in forming a new consortium which obtained the definitive concession in 1852.

From the study of the available documents it becomes clear that the Paris-Lyon represented a conscious attempt by a number of Saint-Simonians to realize the Saint-Simonian goals of a national communications network as the basis for a national industry. It also becomes clear that the July Monarchy was a time, and the founding of the Paris-Lyon an occasion, for the formation of patterns for industrial enterprise which the founders of the Paris-Lyon were to make characteristic of the Second Empire.

315 pages. \$4.05. Mic 57-2467

THE JEWISH IMMIGRANT IN ENGLAND 1870-1914

(Publication No. 21,634)

Lloyd P. Gartner, Ph.D.
Columbia University, 1957

This study is concerned with an aspect of the great age of European migration in the 19th and early 20th centuries, a period during which the same phenomenon occurred among the Jews which resulted in a profound change in their demographic distribution, economic life, and personal status. England was a major source of emigration throughout the 19th century, but for perhaps 100,000 Jews it was a land of settlement. Until the passage of the Aliens Act in 1905 there was unrestricted entry, although the native English Jews tried to discourage or stem the flow, and to send to America or repatriate many who had nevertheless come. However, far greater numbers of Jews, usually en route to America, passed through England and stayed for periods from a few days to several years.

Immigrant Jews lived in communities which existed in every larger English city, especially in the East End of London and in Manchester and Leeds. They were sharply distinct from their surroundings in language, appearance, and social life, and complicated already existing housing problems by severe overcrowding, high rents, and insanitation. The immigrant quarter was the scene of intensive social life and abounded in religious, social, educational, and philanthropic institutions.

The Jewish immigrants made their living at a limited number of trades. A few were peddlers and street sellers but most worked in small and notoriously insanitary workshops, usually with fellow-immigrants as worker-entrepreneurs. Such workshops were economically unstable, helpless before the seasonal fluctuations in their trades. Tobacco manufacture in workshops was declining at the outset of this period, and the boot and shoe trade slowly gave way to factory production in the 1880's and 1890's. The ready-made clothing trade, however, remained in workshops. It became known as the immigrant trade par excellence, to whose development Jewish tailors contributed significantly. London and Manchester contained many small tailoring shops, but in Leeds the units were larger, more mechanized, and later developed into full-scale clothing factories.

Immigrant Jewry in England was the cradle of the Jewish socialist and trade union movement in the 1880's, which attained a precocious doctrinal development yet failed to unionize the major immigrant trades except in Leeds. This lack of success seems largely due to the instability of the trades themselves and to the high turnover of the labor force.

Although a large proportion neglected much of traditional Judaism, the immigrants still retained a vigorous religious and cultural life, largely based upon the East European model. Outside efforts to anglicize this area of immigrant life had little success, for the immigrants kept to their small synagogues (*hevrot*) and showed but slight inclination to more "English" forms of worship. The education of the young, through schools sponsored by the Jewish community and the nascent State system, was inevitably more influential. Immigrant circles themselves maintained old-fashioned one-room schools or modernized Hebraic institutions for Jewish studies; secular study, an object of dispute in Eastern Europe, came about

in England without question. England played a minor role in such new cultural movements as the Hebrew revival, Yiddish belles lettres, press, and drama, as well as Zionism.

The study concludes with observations on the significance of Jewish immigration in modern English and Jewish history. Mention is made of anti-alienism in English politics, and the transformation of the native Jewish community by the coming of great numbers of immigrants.

439 pages. \$5.60. Mic 57-2468

A STUDY OF THE OCCASIONAL CONFORMITY AND SCHISM ACTS, THEIR EFFECTS, AND THE AGITATION FOR THEIR REPEAL, 1711-1719

(Publication No. 20,791)

Henry G. Hood, Jr., Ph.D.
University of Pennsylvania, 1957

Supervisor: Conyers Read

I. Statement of Problems.

A number of questions about the Dissenters in England after the Toleration of 1689 have remained largely matters of guesswork. No one has known the extent to which Dissenters conformed occasionally in order to gain political office. A complete survey is impossible, as even the records of some of the most famous meeting houses of the Dissenters for this period are lacking, but the first detailed attempt on a nation-wide scale is attempted here. Without such information it is difficult to understand fully the role which Dissent played within the Whig party at that time. The precise number of Dissenters who left office on the passage of the Occasional Conformity Act, or chose to remain, cannot be known, though much has been attempted in this study. Until now, the impact of the Schism Act on Dissent has never been thoroughly investigated.

The fascinating story of the means by which the Dissenters and their friends sought to gain the repeal of these acts has been left largely untold. A few historians, notably Wolfgang Michael, Basil Williams, Norman Sykes, and several Nonconformists have, of course, made reference to the subject, but it remained to be told here in detail. An attempt is made here to answer the baffling question of the failure of the Dissenters to gain exemption from all the penal legislation of the time.

II. Procedure.

Newspapers and various manuscript collections in London, Oxford, Cambridge, Bristol, and several in private collections, were studied. In order to discover Dissenters, lists of vestrymen and congregations were taken from meeting-house records, and compared with lists of office-holders. The pamphlet literature of the period was of enormous value.

III. Results.

The information gained in this manner about Dissenters in public positions and offices sheds much light on their position within the Whig Party, and also on their social position. The story of their efforts from August 1714 to December 1718 is told here in detail. It is an account of a

pressure group seeking to gain favorable legislation by every means in its power: by the backstairs, by sermons, by formation of clubs, by printing and distributing of pamphlets, by addresses of loyalty to the king, by bearing arms in battle, and above all, by firm adherence to the Whig Party and the Hanoverian Settlement throughout the entire period.

The debates on the repeal of the Occasional Conformity and Schism Acts are reported here in greater detail than in any previous account. Although there is nothing new as far as the arguments are concerned, the debates, *in toto*, reveal the varying attitudes toward toleration at that time.

IV. Conclusion.

The Toleration Act of 1689 was given reluctantly, and the Tories who were the majority party, curtailed it as soon as possible by the passage of two acts designed to prevent Dissenters from holding office or keeping their own schools.

The Dissenters were assured by the Whigs that the Occasional Conformity Act would be repealed. No such assurance seemed necessary concerning the Schism Act, as it was never enforced. However, the Dissenters felt unsafe with these acts, still part of the law of the land, and proceeded to agitate for their repeal, including frequent demands that other, older laws sometimes enforced against themselves also be repealed. In this additional demand, they were to be unsuccessful until 1828.

The delays to which the Dissenters were subjected revealed the insecurity of their position in England, owing to their enormous unpopularity in the country at large. The debates in Parliament in December 1718 showed that even a government friendly to them hardly dared give them more than the minimum which justice required.

405 pages. \$5.20. Mic 57-2469

THE TURNPIKE MOVEMENT IN VIRGINIA, 1816-1860

(Publication No. 21,116)

Robert Fleming Hunter, Ph.D.
Columbia University, 1957

This study attempts to examine the problems of financing, constructing and maintaining the Virginia system of turnpikes from the point of view of the persons upon whom those tasks fell. It attempts also to discuss the degree of success with which turnpikes supplied the need for improved roads, in terms of their relationships with farmers and with other lines of transportation in Virginia. Finally, it investigates the relationships between turnpikes and politics.

Turnpike financing in Virginia was by a combination of private and public funds in the case of companies that built and operated toll roads as private enterprises, although many turnpikes were built and operated entirely by the State. The State's sources of funds for this purpose were limited; since taxation was not increased appreciably, the main source of funds was the credit of the State. Private funds for investment in turnpikes were scarce, and those who did invest seem to have had other motives than an expectation of profitable stock dividends.

In the construction and maintenance of Virginia turnpikes,

the amateurs who did most of the work had expert advice from the State's Principal Engineer, Claudius Crozet, and his able assistants. Their advice was ignored more often than followed, however, with unfortunate results. The quality of construction and maintenance of Virginia turnpikes is examined in detail in light of the best engineering standards of the day. With few exceptions, they were far below those standards. The evidence seems convincing that people felt little compunction about using the "shun-pikes" (short detours around tollgates) where the quality of the turnpike was little if any better than that of a common road; but if they felt that a turnpike company provided them with a markedly improved road, they were more inclined to pay the tolls.

The individual histories of what have been labelled the "four super-highways" are traced: the Kanawha, the Northwestern, the Staunton and Parkersburg, and the Southwestern turnpikes. These represented the State's weak bid for the western trade, although it must be acknowledged that the three that crossed the Trans-Alleghany section (West Virginia) encountered enormous physical obstacles, and were beset with frustrating economic and political handicaps as well.

The economic life served by turnpikes consisted almost entirely of agriculture. In discussing benefits to farmers, it is concluded that most Virginians were convinced that a system of improved transportation would have to precede any general improvement in agricultural techniques. Turnpikes could compete more successfully with water transportation than is generally thought, because water transport took so much time. Railroad competition with turnpikes was not always fatal, even along parallel lines, but was sometimes actually beneficial.

The periods of greatest activity in turnpike building seemed to coincide with the periods of intensive activity in the field of political reform, preceding the constitutional revisions of 1830 and 1851. There are evidences that the Legislature made an effort to appear generous to the western counties with appropriations for turnpikes, and during the later reform movement attempted to screen even greater generosity to eastern railroads with such appropriations. The westerners were not deceived; their often repeated complaint of discrimination against the Trans-Alleghany in the distribution of internal improvement funds by the Legislature lasted throughout the period, and was one of the principal causes of the dismemberment of the State.

378 pages. \$4.85. Mic 57-2470

A STUDY OF SOCIAL LEGISLATION AFFECTING PRISONS AND INSTITUTIONS FOR THE MENTALLY ILL IN NEW YORK STATE: 1822-1846

(Publication No. 21,709)

Stanley Burton Klein, Ph.D.
New York University, 1957

This is an analytical study of New York State legislative action on penal and mental institutions during the years 1822 to 1846. The principal reference sources are official state documents. Ancillary social, economic and political sources shed light on legislative debates and actions which make possible classification of individual and group interests.

Chapter 1 includes the contemporary significance and related literature of this problem. The policies and practices affecting prisoners and the mentally ill in the United States during the Colonial and Federal periods are treated in Chapter 2. The dominant drives of reform movements in New York State during the years 1822-1846 are the theme of Chapter 3. Interpretation of these subjects reveals that although the Empire State had not been a leader in welfare legislation in earlier periods there was activity in social reforms during the three decades following 1820.

Under the influence of early nineteenth century urge for change and social betterment New Yorkers approached institutional problems unimpeded by dependence on European standards. Selection of criteria for the establishment of internal and external institutional relationships gradually evolved from the various proposals to meet community requirements. The legislative approach to correction programs was through standing committees whose recommendations did not always achieve enactment. However no statute was ever created which did not have a standing committee's unanimous approval. Debates on penalogical benefits to inmates and the community and on the location of the female prison failed to gain any legislative decision until the disputants produced a compromise or were unanimous in their proposals. A governmental attitude of nolle tangere beneficially produced the Auburn System which became the paragon for penitentiary systems in this country and Canada. Its fame stimulated European authorities to inspect New York prisons.

Legislative adoption of the British idea of a self-supporting prison later caused vigorous debate both in and out of governmental circles. Wage-earners dreaded and despised competition with prison labor. Law makers, accustomed to follow compromise or unanimity, as described above, attained no solution until the radical faction of the Democratic Party successfully sponsored the mechanics' cause.

Eight years of spirited debate (1834-1842) resulted in the statute sanctioning prison manufacture and sale of goods not produced within the state, and the non-salable production of articles exclusively for institutional and/or government use. This is the contemporary concept of prison labor.

Sectionalism, playing no role in correction issues, was the bête noire in the establishment of the state asylum. The need for this hospital was born of legislative dissatisfaction with the system of state aid to private hospitals. The western counties, although supporting the proposal for a civil institution, attempted to have it located in their section. Failing in this drive, they managed to restrict construction funds through the political domination of the Whigs. The Utica State Hospital proved to be inadequate and the westerners launched a drive for the establishment of several smaller asylums. With success practically assured, these politicians abandoned their campaign, at least for the time, and directed their energies toward having a House of Refuge for Juvenile Delinquents located in their region of the state. Thus, political maneuvering deprived New York of adequate facilities for the care and treatment of the insane and leadership in the field of mental hygiene during the years encompassed in this study.

381 pages. \$4.90. Mic 57-2471

THE JACKSONIAN PERSUASION

(Publication No. 21,642)

Marvin Meyers, Ph.D.
Columbia University, 1957

This is a study of selected Jacksonian party spokesmen, made with primary concern for the values they communicated to the political public. Specifically, the study seeks a clearer understanding of the political appeal of the Jacksonian Democratic party. Broadly, it seeks further understanding of the American political tradition, and of the character of popular party politics in the American democracy.

In its specific function, the study attends mainly to moral attitudes conveyed through a popular rhetoric, and to the social experiences of the Jacksonian generation which made such attitudes relevant and attractive to a broad constituency. The persistent central theme is the interplay between a highly dynamic social situation, full of novelties and uncertainties for the Jacksonian generation, and a political appeal emphasizing the pure and simple virtues of the Old Republic.

The Introduction sketches the political and social situation in which the Jacksonian and Whig parties emerged, and broadly defines the opposing persuasions they represented. Part of the introductory task is to establish the significance of this opposition for the Jacksonian generation, the felt significance of party conflicts, even where differences over formal political principles were not fundamental and differences over official policy were often marginal and erratic.

Part I of the study, "The Old Republic and the New," begins with an analysis of the social values expressed in Andrew Jackson's presidential messages. It is argued here that the Bank War became, under Jackson's powerful auspices, the dominant symbol of party politics; and that he drew from the Bank issue a pervasive, though hardly a precise or rigorous view of social good and evil. Striking down the Bank of the United States symbolized the destruction of privileged aristocracy, political corruption, and a volatile, impersonal, complex, exploitative economic system based on paper-money banking.

The following chapters of Part I examine aspects of Jacksonian society and character which might suggest the contemporary relevance of Jackson's moral appeal. The observations and interpretations of Tocqueville and Fennimore Cooper are reconstructed, as two broad portrayals of the Jacksonian social situation. The economic processes behind the Bank Monster are characterized; and a comparison is made between Jacksonian social values expressed in political appeals and the practical code of Americans in their ordinary economic and social relations.

Part II of the study explores several "Variations on a Theme by Jackson." Public statements by Martin Van Buren, Theodore Sedgwick, Jr., William Leggett, and Robert Rantoul, Jr. are considered as distinctive versions of the central Jacksonian persuasion, giving emphasis to different elements within that loose aggregate of ideas and attitudes, but still returning to common moral ground.

An extended Epilogue introduces the dialogue of ordinary party politicians in the setting of two state constitutional conventions in New York. The earlier debates, on the eve of the Jacksonian era, are studied for evidence on the style and content of party politics before Jacksonian

Democracy emerged. The later debates, near the end of the era, indicate some major changes in the dialogue of parties which can be attributed to the social and political experiences of the Jacksonian generation.

311 pages. \$4.00. Mic 57-2472

PRESTON KING: A POLITICAL BIOGRAPHY

(Publication No. 21,645)

Ernest Paul Muller, Ph.D.
Columbia University, 1957

Preston King (1806-1865), born in Ogdensburg, New York, remained throughout his political career an authentic spokesman of northern agrarian society. Graduating from Union College, he practiced law in Ogdensburg, joined Silas Wright in the young Jacksonian Democracy and established the St. Lawrence Republican (1830), the leading Democratic paper in northern New York.

In the Assembly (1835), King became an inflexible Radical, but never accepted the ultra anti-corporation doctrines of the Locofocos. For four terms he stubbornly supported hard money policies, fought corruption surrounding bank charter grants and gained a reputation for tireless investigation of illegal banking practices. Demanding an unimpaired state credit, he opposed internal improvements unless supported by taxation, believing whenever economically sound, they could be provided by private enterprise. His vigorous leadership contributed to the Conservative-Radical schism in New York and the formation of the Barnburners.

Elected to Congress (1842), King favored tariff revision on a revenue basis with incidental protection, opposed annexation of Texas, and supported Van Buren's renomination. In the Thirties he resisted agitation of the slavery question, but now believed that a free and productive republican society required the western lands for white yeomen, with slavery excluded. Unenthusiastically supporting the Mexican War, King was a dominant member of those Barnburners who introduced the Wilmot Proviso and made it the foundation of the Free-Soil party.

He reluctantly acquiesced in the 1850 Compromise and accepted the Democratic party reunion (1849-1853), realizing public sentiment opposed further agitation. After the Kansas-Nebraska Act he bolted the party, taking along many former Barnburners. Committed to prohibition of slavery in territories and its inviolability in states, he became a founder of the Republican party. As Senator (1857-1863), his uncompromising attitude was strengthened by a conviction that disunion threats came from irresponsible men unprepared to carry them out. Failing to secure Seward's nomination (1860), King supported his entry into Lincoln's Cabinet but favored balancing Whig influences with former Barnburners Welles and Blair.

King opposed compromise during Secession Winter though recognizing the alternative might be civil war. After Ft. Sumter, he constantly urged vigorous military action. Except when defending Seward during the 1862 Cabinet crisis and supporting the Administration's attempt to build an effective fighting force, King was a Radical. He favored emancipation, use of Negro troops and experimental settlement of freedmen on confiscated plantations.

Events modified his free-soilism with growing concern for the Negro. Although he abandoned the idea of segregation, Reconstruction showed his belief in freedom and economic opportunity for the Negro did not extend to suffrage: King retained his moderate states rights view that states should determine voting qualifications.

New York's factional strife prevented King's reelection (1863), but did not end his influence. He favored Lincoln's candidacy, was a major agent in Johnson's nomination and became Johnson's intimate advisor, living with him during the early months of his Administration and influencing Reconstruction policy. In September 1865, King became New York Collector of Customs. Two months later, during a mental illness caused by overwork, he committed suicide.

King's record was singularly unblemished by suspicion or fact of corruption. He was always a Jacksonian in his belief in a limited central government, the collective wisdom of the people and his antagonism to special privileges. He thought in terms of passionate absolutes, but rarely acted in passion. Although a tenacious fighter, he developed a capacity for patience. Willing to relinquish old party allegiances to advance his principles, he nevertheless displayed ability for harmonizing discordant partisan elements. Perhaps his lasting achievements were forwarding the cause of freedom and being one of the primary organizers of the Republican Party.

795 pages. \$10.05. Mic 57-2473

THE UNITED STATES AND THE LONDON NAVAL CONFERENCE OF 1930

(Publication No. 21,576)

Raymond Gish O'Connor, Ph.D.
Stanford University, 1957

This dissertation is a study of the London Naval Conference of 1930 within the framework of American foreign policy and naval policy. The conference marked the culmination of a movement for security through disarmament that was partly inspired by the disillusionment following World War I. The negotiations reveal the correlation between national interest and international affairs, and furnish insight into the role of the navy in foreign policy.

The imperialism that had prevailed at the turn of the century in the United States, Britain, and Japan was formally renounced by these nations in 1930. Each nation denied itself the right to build and maintain sufficient naval forces to sustain an offensive war against the other. The treaty temporarily stabilized conditions in the Pacific, but it failed to settle the problem of competitive armaments in Europe. The reason for this failure lay in the diverse manner in which the security of the various nations could be threatened. The multiple vulnerability of the continental European nations was a fundamental consideration in their contention that limitation should be applied to all weapons or to none.

Public opinion played a significant role in determining the positions of London, Paris, and Washington. The French were pursuing security through armaments and mutual assistance pacts. Britain and America were determined to avoid responsibilities that were not directly related to the nation's welfare and interest. The leaders were restricted to activities which the public and the press would sanction.

The three-power agreement at London represented a victory of the civil authorities over the steadily encroaching naval experts. The delegates were willing to make the compromises necessary to reach agreement with the other nations, and in this respect they subordinated national interest to international cooperation. The treaty improved relations with Britain and Japan and helped sublimate the suspicion aroused by naval competition.

The treaty did not prevent the United States from maintaining a navy sufficient to uphold its foreign policy. Actually, the London pact was responsible for the formulation of an orderly and comprehensive shipbuilding program. Furthermore, America was not obligated to furnish military aid to any nation, and she had assumed no ties that would cause her to become involved in a European struggle. The established ratio authorized a navy adequate for contemplated needs.

The authorities in Washington, London, and Tokyo wanted a treaty. Paris was opposed to an agreement confined to naval limitations, and Rome seemed sympathetic but not enthusiastic. Those nations that were sufficiently eager for a treaty made the concessions necessary to obtain one. The others refused to modify their demands and remained outside of the more restrictive provisions of the pact.

The conclusion of the treaty demonstrated that agreement on armaments was possible only when there were no outstanding political controversies among the nations. Isolation from potential enemies and the absence of major problems made possible a three-power pact among Japan, Britain, and America. Unfriendly neighbors and quarrels between France and Italy prevented a five-power agreement.

The London Naval Treaty of 1930 was important because, for the first time, all of the naval weapons of three great nations were limited and a relative position of naval power was established. Furthermore, these nations relinquished their freedom of action to provide for their own security in order to achieve an international agreement.

The author was granted unrestricted access to the files of the Department of State and the Navy Department, both of which contain documents bearing on the negotiations, as well as numerous press reports of representatives in the various countries and thousands of newspaper clippings pertaining to the conference.

308 pages. \$3.95. Mic 57-2474

THE STORY OF THE AMERICAN CANCER SOCIETY

(Publication No. 21,620)

Donald Francis Shaughnessy, Ph.D.
Columbia University, 1957

In 1913, more than seventy-five thousand persons in the United States died of cancer. The disease had completely engulfed the professional as well as the public mind in an atmosphere of fear, fatalism, and resignation. One cause for this attitude was the extremely low percentage of "cured" patients. In an effort to change this condition, a group of prominent gynecologists and laymen, led by Drs. Howard Taylor, Clement Cleveland, and Thomas Cullen, held several informal meetings which ultimately led to the founding of the American Society for the Control of Cancer in May of 1913.

During the early years of its existence, the Society's efforts were hampered by service of many of its workers in World War I, and by the absence of any trail-blazing organization to act as guide. The financing during these early years was on a year to year basis and the Society was entirely dependent on its small membership fees and gifts from generous donors; in the first decade of its history the budget never exceeded fifteen thousand dollars. Throughout the decade of the twenties the Society's work was severely limited by its straitened circumstances, and it was not until 1927 -- when a million dollar endowment fund drive was successfully undertaken -- that for the first time the Society was on financially solid ground. From its inception in 1913, the Society continued to emphasize the need for public education, despite dissident voices within its ranks.

By 1929, the Society was a national organization on paper, but in reality its activities were almost completely confined to the Atlantic seaboard. To remedy this and other problems, the Society was reorganized, the most important result of which was the appointment of Dr. Clarence Cook Little as Managing Director. Dr. Little's first move was to emphasize cancer education for the medical profession, rather than the public.

Through the use of field representatives, an attempt was made to awaken the medical profession west of the Alleghenies to the cancer problem, but the Great Depression of the thirties seriously hampered this work. However, in

spite of the troubled times and dissension within its ranks, the Society pushed forward. With the formation of the Women's Field Army in 1935, the major lay educational branch was created and within five years the Society was known from coast to coast. Its continuing educational efforts culminated in the establishment in 1937 of the National Cancer Institute by the federal government.

The Society continued to expand throughout the years of World War II, albeit at a diminished pace. By 1944 its annual budget exceeded eight hundred thousand dollars and its membership totalled more than a million. In this year, also, a thorough overhaul of the Society was begun. When the "new" Society emerged three years later, it was a highly efficient and greatly enlarged organization. Henceforth its efforts would be directed along three main lines: research, education, and service. Laymen were given positions of major responsibility, serving on both the Board of Directors and the Executive Committee.

Today the Society spends more than thirty million dollars annually in its efforts to eradicate cancer, and can claim major credit for the increased interest of the federal government in this problem. Through its pioneer efforts in cancer control, it set an example for other voluntary health organizations which constantly seek its advice. More directly, it has served as a beacon light for cancer societies in European and Latin American countries, and has been the primary force behind the international cancer conferences.

279 pages. \$3.60. Mic 57-2475

HOME ECONOMICS

THE INFLUENCE OF IMPROVED DIET ON CERTAIN BLOOD CONSTITUENTS OF MEN AND WOMEN WITH ACTIVE TUBERCULOSIS

(Publication No. 21,062)

Eva Yen-hwa Hwang, Ph.D.
Michigan State University, 1954

The influence of an improved diet on the fasting blood content of hemoglobin, serum total protein, vitamin A, carotene, ascorbic acid and alkaline phosphatase of 19 women and 34 men with moderately advanced, and far advanced, active tuberculosis was studied.

The average daily dietary intake was calculated and the fasting blood constituents of hemoglobin, total serum protein, vitamin A, carotene, ascorbic acid and serum alkaline phosphatase were determined for each subject during a seven-day control period. Modifications were made in the regular hospital diets of the subjects so that a generous intake of nutrients was supplied to all subjects during the experimental period which lasted for four months and was divided into three periods of six weeks each. A vitamin supplement containing vitamin A, ascorbic acid, thiamine, riboflavin, and niacin was given daily during the experimental periods. At the end of each period, a seven-day food record was obtained from each patient and the dietary intake was calculated. Also at the end of each period a blood sample from each patient was analyzed for

hemoglobin, serum protein, vitamin A, carotene, ascorbic acid and alkaline phosphatase.

Statistical analysis indicated that there was an increase in the concentration of hemoglobin in the blood of men and women patients with far advanced, active tuberculosis during the experimental period in comparison with the control period. Mean blood hemoglobin values of patients with moderately advanced, active tuberculosis were comparable to that of healthy adults in the control period and there was no significant change during the experimental period. There was no change in mean serum protein values in the experimental periods as compared with the control period.

The average mean serum vitamin A values for all groups were comparable to those of healthy adults in the control period although there was wide individual variations. No difference between the control and the experimental periods was found for any group except for the women with moderately advanced, active tuberculosis; the mean serum vitamin A for women with moderately advanced, active tuberculosis was significantly higher in the experimental periods than in the control period.

The daily dietary supplement of 150 milligrams of ascorbic acid during the experimental periods resulted in a statistically significant increase of serum ascorbic acid values in comparison with the control period.

There was not a significant difference between the mean serum alkaline phosphatase values in the control

period and the experimental periods for any group except for the women with moderately advanced, active tuberculosis; this group had a higher mean serum alkaline phosphatase in the control period than in the experimental periods.

There was an increase during the experimental period in the concentration of the particular blood constituent for patients who had low initial values of blood hemoglobin,

serum vitamin A and/or serum ascorbic acid. There was also a reduction in serum alkaline phosphatase activity during the experimental period for those patients whose initial values were higher than for healthy adults. The concentration of the various blood constituents at the end of the experimental period was similar to that of healthy adults for all patients.

190 pages. \$2.50. Mic 57-2476

LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, GENERAL

THE LITERARY SIGNIFICANCE OF JOHN EACHARD (Publication No. 21,568)

James Rousseau Dickinson, Ph.D.
Stanford University, 1957

John Eachard (1636-1697), seventeenth century English author, educator and divine, has long been known to historians for his observations on the state of the English clergy of his time, mainly because Thomas Babington Macaulay, in the third chapter of his History of England from the Accession of James II, used Eachard's Grounds and Occasions of the Contempt of the Clergy as source material in such a way that he touched off a controversy over the state of the clergy which has lasted well into the twentieth century. Moreover, Eachard's criticism of preaching style, and the relationship of that criticism to the late-seventeenth-century controversy over prose style in general, have been dealt with thoroughly by Professor Richard F. Jones and other modern literary scholars. The significance of Eachard in English historiography, and in the shifting seventeenth-century attitudes toward style, is thus clear. But Eachard's full status as a man of letters and hence his contribution to the history of English literature have yet to be determined, in spite of the fact that John Dryden, Jonathan Swift, and other men of literature from Eachard's own time to the present have valued him as a writer whose works reveal considerable wit and satirical power. It is therefore my purpose in this dissertation to evaluate as fully and carefully as possible the position which John Eachard and his writings hold in the stream of English literary history.

In order to accomplish this I have described the important elements of Eachard's works, with special attention first to the Grounds and Occasions and to his Observations upon an Answer to an Enquiry into the Grounds and Occasions, and the controversy over his use of wit and satire which these works aroused. There follows next an analysis of his two dialogues against Thomas Hobbes for their points of attack on Hobbes's philosophy and their special satiric techniques, after which the whole controversy over the proper place of wit and ridicule is traced from its earliest manifestations in the mid-seventeenth century through the age of Swift, and Eachard's significance in this controversy is made clear. Finally, Eachard's own writing style and his use of satiric methods are analysed in some detail.

Thus it becomes clear that the significance of Eachard's literary position is mainly dependent upon three factors. The first of these has to do with what he wrote. From an examination of his first two works it is clear that what he had to say concerning matters of education and the condition of the Anglican clergy constituted valid, solidly based critical commentary upon problems which were real and vital to many Englishmen of his day. Moreover, his two dialogues, directed against one of the most cogent thinkers of the period, would stand as real contributions to the literature of philosophical criticism, on the basis of their logical and critical qualities alone. A second factor of Eachard's position in literary history has to do with the significant relationship which the attack on his first two writings had to the growing controversy over "true" and "false" wit in literature, a controversy which was soon to affect Swift, and which would concern Pope as a threat to literature itself. The third and most important factor of Eachard's literary significance has to do with how he wrote. It was the quality of Eachard's wit and the range of his satirical talent which involved him in the controversy just mentioned, and which impressed men like Dryden and Swift. And it is this same satirical wit which more than anything else entitles Eachard to a place in English literary history which has not hitherto been accorded him.

241 pages. \$3.15. Mic 57-2477

AN INTRODUCTION, GLOSSARY, AND INDEX FOR AN ALPHABET OF TALES

(Publication No. 21,556)

Leo Frank Fittable, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Irving H. White

An Alphabet of Tales (c. 1450), a translation of the Alphabetum Narrationum (c. 1308), was edited from British Museum Additional MS. 25,719 by Mrs. Mary MacLeod Banks, and published by the Early English Text Society in two parts: EETS OS 126 (1904), EETS OS 127 (1905). In the Note preceding Part II, Mrs. Banks stated that an introduction, glossary, index, and "general clearing-up" would be provided in a forthcoming Part III. This volume, however, has never appeared, and the Early English Text

Society has abandoned the project. It is the purpose of this dissertation, then, to provide an apparatus designed to be used with Mrs. Banks's edition.

The Introduction, which consists of three chapters (Manuscripts and Authorship, Classification and Sources, and Language), gives chief consideration to language, presenting a detailed study of sounds, orthography, inflections, and syntax. The treatment of inflections and syntax is modeled after that of two special studies of the language of the fifteenth century, Leon Kellner's Introduction to Caxton's Blanchardyn and Eglantine, EETS ES 58 (1890), and Charles S. Baldwin's Inflections and Syntax of the Morte d'Arthur of Sir Thomas Malory (Boston, 1894). The Glossary attempts to record every word appearing in the text, including inflectional forms and variant spellings, with references to page and line of the EETS edition. Etymologies are provided for unusual forms. The Glossary of Proper Names contains a complete list of the saints who appear in the tales, as well as names of the more important classical and medieval figures. The Index to the Tales lists the tales according to the English titles, supplied by Mrs. Banks, which appear at the top of each page in the EETS edition.

The combined efforts of Barthélemy Hauréau and J. A. Herbert disposed of the earlier attribution of the Alpha-betum Narrationum to Étienne de Besançon, and established Arnold of Liège, a Dominican of the early fourteenth century, as the rightful author. However, nothing is known about the English translator except that the language points to someone from the North of England. The 801 tales, compiled as exempla for use in sermons, represent a variety of narrative types: romances, fables, humorous tales, anecdotes (about twenty per cent of the total), saints' legends (about twenty-five per cent), and pious tales (about thirty per cent). Their sources are found in the sacred and profane literature of antiquity (about thirty-five per cent) and in the didactic literature of the Middle Ages (about sixty-five per cent). In the first category the principal source is the Vitae Patrum; in the second, the Dialogus Miraculorum of Caesarius of Heisterbach. (A complete list of sources and tales derived from them appears in an appendix.)

The dialect is Northern, with some non-Northern characteristics in phonology, the evidence of which is difficult to evaluate because of the lack of rime. The chief features of the language are as follows: (1) OE ā appears as a, but almost as frequently as o; late OE ā, which developed before consonants, appears as a, but more frequently as o; OE ā before nasals is usually a; (2) the second and third persons singular, present indicative, end in -is (-ys); the plural of the present indicative ends in -is, or is without ending; preterits of strong verbs have the same vowel in the singular and plural; the present participle ends in -and (beside a much less frequent -yng); only b-forms of the personal pronoun, third person plural, occur; (3) the vocabulary contains a large number of words, most of them of Norse origin, found only or principally in Northern texts: abown, at (to), bown (about to), burd (behooved), gate (path), etc. 552 pages. \$7.00. Mic 57-2478

NINETEENTH AND TWENTIETH CENTURY CRITICISM OF SHAKESPEARE'S PROBLEM COMEDIES

(Publication No. 21,252)

Harry Caesar Morris, Ph.D.
University of Minnesota, 1957

The primary purpose of any survey of criticism is to bring together, for easy access, the chief opinions of the chief writers. That a need for a survey of Shakespeare criticism exists can be shown best by citing the opinions of two such divergent critics as T. S. Eliot and J. Isaacs. Mr. Eliot states that "when a poet is as great as Shakespeare is, we cannot judge of his greatness unaided; we need both the opinions of other poets, and the diverse view of critics who were not poets, in order to help us to understand. Every view of Shakespeare is an imperfect, because a partial view." Therefore, a survey of Shakespeare criticism should be helpful in providing a plan for the study of the writings of the important critics, with the ultimate purpose of illuminating the plays themselves.

Writing from the viewpoint of the historical scholar, Professor Isaacs believes that the survey, in general, helps the critic survey the field: "It would seem as though the future of Shakespeare scholarship lies in the organization of new co-operative methods. A systematic stock-taking of what has already been achieved will indicate much of what remains to be done." It has been the aim of this survey to accomplish these two ends: to isolate the existing critical writings on Shakespeare's problem comedies in order that we may better understand the plays and that we may more easily know what is yet to be done in the way of scholarship.

This survey is limited to criticism of the problem comedies from Coleridge to midyear of the twentieth century. These arbitrary limits were set because it was felt that almost no problem comedy criticism existed before Coleridge and that a limit later than 1950 would lead only to confusion because of the problems of trying to keep up with a criticism which T. S. Eliot describes as "increasing every day at compound interest." The criticism that precedes Coleridge is not ignored entirely; in fact, there is so little that the glance backward given to pre-nineteenth century criticism includes almost all the materials known, and, in effect, the survey is complete from Meres' Palladis Tamia (1598) to 1950.

If anything of a sweeping nature can be said about problem comedy criticism, it is this: Prior to E. E. Stoll but after Dr. Johnson, the criticism may be termed Romantic. It is with the important work of Professor Stoll that a new and realistic scholarship replaces the character studies of nineteenth century criticism. Stoll insists that Shakespeare's characters not be treated as flesh and blood; they are created puppets and must not be expected to exhibit lifelike qualities nor psychological consistency.

Not going back completely to critics like A. C. Bradley nor the entire century of writers whose work leads inevitably to his, a school of critics in opposition to Stoll reasserts that a certain poetic, dramatic, and psychological consistency does exist in Shakespeare's plays, even in the problem comedies. This group may be called the Scrutiny critics, and they derive ultimately from the work of G. Wilson Knight.

The survey concludes that the criticism of these plays is diverse, and it is good that diversity exists. All views

are partial views; many are needed for a clearer picture of the literary object. When the object of criticism is exhausted of its richness, the object dies and, of course, criticism along with it. 553 pages. \$7.05. Mic 57-2479

VOLTAIRE'S MINOR COMEDIES AND TRAGEDIES

(Publication No. 21,616)

Robert Emmett Pyle, Ph.D.
Columbia University, 1957

Although Voltaire dominated the French stage from 1718 to 1830 with a dozen tragedies and three comedies, he wrote many other plays which fell by the wayside. The two successful tragedies, while prolonging classical tragedy, contained elements of propaganda and spectacle which contributed greatly to the transformation of the genre into melodrama, the Romantic theater of Hugo, and the realistic problem play of the nineteenth century. His ten minor tragedies, written after 1760, either were not presented at the Comédie Française or were unsuccessful from any viewpoint. Nevertheless, they are important for the light they cast on Voltaire's philosophical position and political activity, and his persistent attempts to surpass Corneille, Crébillon, and Shakespeare. In the texts and even more in his notes and prefaces, Voltaire advocated religious tolerance, the separation of Church and State, constitutional monarchy, and in his last play, Agathocle, a republic is established through a king's abdication. Literal interpretation of the Old Testament is rejected scornfully and a factual approach to history is promulgated. In his successful tragedies, written earlier in his career, these attitudes were expressed mildly and indirectly, with conciliatory gestures intended to insure the plays' presentations. His minor tragedies, especially Olympie, show a greater regard for spectacle, rendered possible after 1760 by the barring of the spectators from the stage. His use of spectacle, local color, and contrast between races and civilizations was intended to maintain his hold on the public fancy, but Voltaire always insisted that such devices should be determined by the plot and subordinated to poetical charm, lest tragedy become vaudeville. As a concession to Diderot, he allowed middle-class characters and a more familiar dialogue, and attempted a philosophical drama in prose. Romantic love, which Voltaire always decried but considered necessary for success in the theater, is present on the whole in the later tragedies, an indication that he had not despaired of their presentation. Repetitious and imitative of his earlier plays as well as those of Corneille and other writers, Voltaire's minor tragedies attest to his lifelong devotion to the theater and his desire to use it as a propaganda medium during a period when his creative powers were failing and his interests involved in the crucial struggle which resulted in a more liberal, materialistic way of life.

Voltaire's three main comedies, L'Enfant prodigue, Nanine, and L'Ecossaise, all showed great concessions to the comédie larmoyante which he officially condemned. His ten minor comedies, although a sentimental approach was occasionally apparent, conformed more closely to his ideal of classical comedy, conditioned by his adulation of Molière. This esteem was so great that he despaired of

equaling the latter's comic characters, and confined himself to writing flat comedies of intrigue or situation in which he imitated Molière, Vanbrugh, Cibber, Collé, Destouches, and probably other writers. In two comedies not intended for presentation, Vanbrugh and Cibber were merely translated in passages. Voltaire aspired toward a gay, conservative comedy in verse form, rejecting farce and obscenity on the whole, and using an easy, flowing style. Yet humor, despite flashes of wit, is lacking; the characters, with few exceptions, are stereotypes in which Voltaire's own personality and ideas are predominant; the plots lack probability. Unlike his tragedies, the latter comedies reflect Voltaire's ideas no more than do the earlier ones. He did not regard comedy as a means for dissemination of propaganda, despite his indictment of religious hypocrisy and his occasional use of lower-class characters who resent aristocratic privilege. His comedies, even more than his tragedies, suffer from the inhibiting influence of preconceived ideas and deserve the oblivion into which they have fallen.

175 pages. \$2.30. Mic 57-2480

LANGUAGE AND LITERATURE, LINGUISTICS

EFFECTS OF SELECTED PHONETIC ASPECTS IN THE TRANSMISSION OF THE SPANISH LANGUAGE

(Publication No. 21,474)

Cruz Aurelia Cancel Ferrer Hardigree, Ph.D.
The Ohio State University, 1957

The objects of this research were to establish, through the study of words common to Spanish-American countries, a vocabulary that might be used with some foreknowledge in appraising talkers, listeners, and communication equipment, and to discover words that might be used alongside them in the response form of a multiple-choice intelligibility test. Incidental rewards of the study were first approximations about the characteristics of the language that differentially affect intelligibility.

A list consisting of 1,000 test items of Spanish bisyllabic "grave" words was developed. The words were taken from a sample of 2,862 bisyllabic "grave" words from newspapers of 19 Spanish-American countries: Argentina, Bolivia, Chile, Colombia, Costa Rica, Cuba, Ecuador, Guatemala, Honduras, México, Nicaragua, Panamá, Paraguay, Perú, Puerto Rico, San Salvador, Santo Domingo, Uruguay, and Venezuela.

The 1,000 words were assigned in a scrambled order to 20 lists of 50 items each. Ten Spanish-American male speakers spoke these words for recording. The recorded lists were played back through headsets, under conditions of quiet and noise, to 65 listeners from Spanish-American countries. The listeners, serving in panels of six or seven members each, wrote down the words they heard.

Speakers and listeners varied from one panel to the next, and measures deriving from them were confounded in the results. Intelligibility values of listening panels, speakers, lists, and words were computed.

The contribution of each major orthographic-phonetic unit to the intelligibility of the words under the conditions of this test was appraised. Preservation-in-error values were computed for each major orthographic-phonetic unit from the error-responses to a sub-sample of 100 words. Substitutions for the stimulus sound units were obtained for each word in the 100-word test.

The relative intelligibility values of Spanish-American words in quiet and in noise were significantly correlated ($r = .53$). Fifty-item lists of "grave" words were, in general, adequate in length to yield similar values in intelligibility testing.

Factors that appeared to affect the intelligibility of the Spanish bisyllabic "grave" words were isolated and, as first approximations, were (1) the accented syllable, (2) the presence of four orthographic-phonetic units in a word, as opposed to a larger number, (3) terminal vowels in a word, as opposed to terminal consonants, (4) the occurrence of a vowel-consonant order in a syllable, as opposed to the consonant-vowel order, and (5) the presence of particular orthographic-phonetic units in a word, viz., [f], [l], [wa], [ai].

186 pages. \$2.45. Mic 57-2481

VERBAL AND NON-VERBAL PATTERNS OF
RESPECT-BEHAVIOR IN VIETNAMESE SOCIETY:
SOME METALINGUISTIC DATA

(Publication No. 19,991)

Nguyễn Dinh Hòa, Ph.D.
New York University, 1956

The problem is to analyze the most significant patterns of Vietnamese respect-language in correlation with non-verbal patterns of Vietnamese respect-behavior. Such an analysis further illustrates the extent to which language can be a guide to culture, thus testing the applicability of the Sapir-Whorf hypothesis to the case of Vietnamese. The description of certain socially-determined linguistic patterns used by Vietnamese in their daily intercourse reveals dominant traits of Vietnamese culture and contributes to the understanding of the ways in which Vietnamese think, feel, believe and behave--as well as talk and write.

Speakers of all three dialects (Tonkinese, Cochin-Chinese, and Annamese) were asked to give the linguistic forms actually employed and to describe the contexts. Informants included students, government officials, businessmen, and restaurant workers.

Modes of address and reference make use of kinship terms, personal names, titles--official, occupational and social--personal pronouns, personal classifiers, and "polite particles."

The kinship terminology in Vietnam is classificatory. Kinship classes are defined by nuclear terms. Secondary modifiers indicate sex, relative age, generation and closeness of blood ties.

Within the family, each term of relationship is used not only as designative or vocative, but also as personal pronoun to show exact relationship between speaker and hearer. The pair me-con 'mother-child' means 'you-I' when used by the child, and 'I-you' when used by the mother. The term anh 'elder brother,' ordinarily is em-

ployed also by husband and wife to mean respectively 'I' and 'you.' The wife is called and refers to herself as 'younger sibling' (em).

This unique situation is found even outside the context of family relationships. For instance, in a fictitious extension of the family, the term ong 'grandfather' serves as second-personal pronoun when the person spoken to is 'a man of about forty years old,' the first-personal pronoun being toi 'servant.'

A number of personal pronouns are not kinship terms, but other substantives used to denote occupation, age, sex, and social status.

There are also several "arrogant" pronouns.

Proper status is furthermore indicated by special classifiers. One says, "one grandfather mayor," "a brother laundryman," "a rascal thief," etc.

As members of the kin group are classified into categories, so other members of the society at large are assigned different statuses concomitant with their respective groups. The factors of age and learning are much prized. The gerontocratic system originated from the choice of older men as officiants of the native cult of village tutelary gods. Learning, traditionally in the form of a mastery of religious rites prescribed by Confucian ethics, has always been the criterion for recruiting civil servants.

Vietnamese society has a tightly woven culture. The dominant theme as expressed through the language is "to take one's proper position among other members of the community." "Names" should be correctly used. An individual has a pathological fear of offending other people and of losing face. The Vietnamese value personalized relationships over impersonal relationships, and have a strong sense of social differences.

The difficulties involved in Vietnamese translation work can be resolved only through a comprehension of the ways Vietnamese language shapes Vietnamese thinking. Each lexical item has to be examined in terms of all the social situations where it occurs.

Microlinguistic analysis--description of language on the levels of phonology and morphemics--makes use of only differential meaning (the informant is asked only whether items under consideration, from phonemes through sentences, are the same or different). Metalinguistic analysis--description of language on the level of meaning--has to consider referential or cultural meanings as well (who is talking to whom, under what circumstances, and how speaker and hearer interact and react to the "word" in terms of their common cultural background). More metalinguistic data will be needed if the whole area of macrolinguistics is to be exhaustively covered.

283 pages. \$3.65. Mic 57-2482

THE ORIGIN OF THE USE OF I AS A SIGN
OF LENGTH IN MIDDLE SCOTS

(Publication No. 21,609)

Francis Marion Kelly, Jr., Ph.D.
Columbia University, 1957

One of the most striking characteristics of the Scottish orthography of the fifteenth and sixteenth centuries is the use of i as a sign of length. During this period a

non-etymological i or y was regularly written after another vowel to indicate that the first vowel was long, for example, in maid (OE. *macode*) 'made,' baith (ON. *baðir*) 'both,' neid (OAngl. *nēd*) 'need,' and rois (OF. *rose*) 'rose.'

The generally accepted explanation of these spellings has been that they are due to an early Scottish monophthongization of all of the Middle English diphthongs with i as their second element. According to this theory as it was originally stated by Sir James A. H. Murray in The Dialect of the Southern Counties of Scotland, after these i-diphthongs had become simple monophthongs, the letter i, which was sometimes retained in spelling, came to be regarded as a sign that the preceding vowel was long, and a non-etymological i was added to simple long vowels to indicate their quantity. Most scholars who have discussed the use of i as a length sign in Middle Scots agree substantially with Murray. However, there are some differences of opinion, and no one has made any special investigation of the problem since Owen T. Williams' article "The Development of ai and ei in Middle Scotch" was published in Transactions of the Philological Society in 1910.

Besides the scholarship dealing directly with the use of i as a length sign, a few studies of modern Scottish dialects help to clarify the circumstances under which this orthographical convention originated.

Since Murray believed that the monophthongization of the i-diphthongs in Scotland was caused by the inability of speakers of Gaelic to pronounce correctly the i-diphthongs of Middle English, the possibility of Gaelic influence should be reconsidered. Although the phonology of Gaelic may have been a factor in the monophthongization of the i-diphthongs of Middle English, it seems more probable that they were monophthongized independently of any foreign influence.

The texts investigated for this study are examined primarily for rime evidence rather than for spellings because the spellings are extremely irregular and because there is often a period of fifty years or more between the time of composition of a given work and the time at which the earliest extant manuscript was copied. In an accurately rimed text, a rime of an etymologically justified i-diphthong with an etymologically justified monophthong indicates the monophthongization of the diphthong, for example: fair (OE. *fæger*) 'fair': war (ON. *váru*) 'were' (Buke of the Howlat, 308-312).

The rimes in the following works are examined: The Bruce (1375), Pistill of Swete Susan (14th c.), Scottish Legends (late 14th c.), Wyntoun's Chronicle (Wyntoun's part, ca. 1420; anonymous part, ca. 1390), Ratis Raving (1400-1450), Scottish Troy-Book (15th c.), The Buik of Alexander (1438), Buke of the Howlat (ca. 1450), and The Wallace (ca. 1475).

The most important cause for the use of i as a length sign in Middle Scots seems to have been the monophthongization in non-final position of ME. ai of all sources and of ME. ei < OF. ei. In final position these diphthongs were not monophthongized, as Murray and others thought. There is virtually no evidence for the monophthongization of ME. oi, and there is no rime evidence at all for the monophthongization of ME. ui. The works that contain the clearest evidence of the monophthongization in non-final position of ME. ai and of ME. ei < OF. ei also show more clearly than the other works investigated that ME. ā and final ME. ē had been raised. These facts strongly suggest that, as in England a century later, the monophthongization of ME. ai

in Scotland was related to the diphthongization of ME. i as ME. ē rose towards [i:] in the Great Vowel Shift.

189 pages. \$2.50. Mic 57-2483

VERB FORMS OF THE NORTH CENTRAL STATES AND UPPER MIDWEST

(Publication No. 20,525)

Virginia Glenn McDavid, Ph.D.
University of Minnesota, 1956

That different verb forms are found in rustic speech, common speech, and cultivated speech has been recognized, but the extent of these social differences as well as the presence of regional ones has received less attention. During the past 25 years a body of comparable data on vocabulary, pronunciation, and grammar has become available in the records of the Linguistic Atlas of the United States, and it is with the verb forms found in the Linguistic Atlas records from the North Central states of Wisconsin, Michigan, Ontario, Illinois, Indiana, Kentucky, and Ohio and the Upper Midwest states of Minnesota, Iowa, North Dakota, South Dakota, and Nebraska that this study is concerned. The materials for these states comprise 629 records, made largely from 1938 to 1956 by 18 field-workers. The questionnaire used contains over 700 items, nearly 100 of which deal with verb forms.

Regional and social variations along the eastern seaboard were studied by E. Bagby Atwood in A Survey of Verb Forms in the Eastern United States (Ann Arbor, 1953); he came to the general conclusion that nonstandard verb forms have a regional as well as a social distribution and that the distribution of the forms is similar to that of the lexical items in the Linguistic Atlas questionnaire. On the basis of Atwood's book and the population movements westward, it is possible to predict surprisingly well what verb forms will be found in the North Central states and Upper Midwest, and these predictions are substantiated by the records. The population history of these states is clearly reflected in the distribution of verb forms. However, the areas are not so distinctly marked as along the eastern seaboard, and the further west one goes, the less distinct they are. Settlers from western New England and New York moved into northern Ohio, northern Indiana, northern Illinois, Michigan, Wisconsin, and Minnesota, carrying with them such characteristic Northern speech forms as clim, dove, and hadn't ought to. Central Ohio, Indiana, and Illinois were populated by Pennsylvania settlers following the National Road; with them came North Midland and Midland speech forms like got awake and clum. From the western counties of Virginia and North Carolina the Pennsylvania-derived speakers of South Midland migrated into Kentucky, and from Kentucky into southern Ohio, southern Indiana, and southern Illinois. With them came such forms as dog-bit and shrinkt.

The boundary between Northern and South Midland speech, the two dominant types, is fairly sharp in the states east of the Mississippi River. West of the river it is not possible to draw any such boundaries, either because the distinctive forms are not found, or because they are scattered from the Canadian border south to Nebraska.

Cutting across the lines of regional distribution is the

social distribution of the forms. This too follows in general the distribution found along the eastern seabord. But, as one goes west, the forms characteristic of the oldest group are found with decreasing frequency. The proportion of the oldest group of Minnesota informants who say come as a preterit, for example, is less than that of the middle-aged group of Kentucky informants who use it. Forms typical of the speech of the oldest and least-educated group are blowed, drownded, and hain't.

The status of dreamed and dreamt, kneeled and knelt, and learned and learnt is uncertain.

293 pages. \$3.80. Mic 57-2484

LANGUAGE AND LITERATURE, MODERN

TRAGEDY AND THE JACOBEAN TEMPER: A CRITICAL STUDY OF JOHN WEBSTER

(Publication No. 21,630)

Richard A. Bodtke, Ph.D.
Columbia University, 1957

John Webster's The White Devil (1612) and The Duchess of Malfi (1614) are products of that undercurrent of Renaissance pessimism which broke forth with renewed violence during the first two decades of the seventeenth century.

Webster's extensive borrowings from Montaigne indicate his sympathy with Montaigne's ironic devaluation of mankind. Seizing upon Montaigne's skepticism and distorting his "smiling irony" by taking it at face value, the Jacobean uses his criticism of mankind as proof of man's degeneracy. Such an orientation is indicated by Webster's self-conscious moral ambivalence to both good and evil, his view of man as merely animal, and his denigration of the powers of reason.

Coupled with the skepticism of Montaigne is Webster's acceptance of Machiavellian doctrine. Although the pseudo-Machiavel is common to both the earlier Elizabethan and the Jacobean drama, the latter drama is distinctly darker in tone, and much of this "darkness" stems from a rueful acceptance of man's innate evil, a view propagated in part by Il Principe. Webster's world is almost totally evil--except for those few characters who are conspicuously weak in their goodness and for the Duchess who possesses both virtue and stoic fortitude.

Darkening Webster's drama even more are those strains of melancholy and despair common to many men of the early seventeenth century. A kinship of John Donne with Webster is noticeable not only in their common despair but in Webster's borrowing of pessimistic lines from Donne's anniversary poems in the similar qualities of their verse. Webster attempts to reconcile the chaos of his world within his imagination by stage action and by verse which is alternately dark in color or "metaphysical" in its attempt to reconcile a dissident skepticism with an emotional need for organizing belief.

Dramatically, Webster (like other Jacobeans) echoes the cosmic pessimism behind the "stoicism" of Seneca, utilizes Seneca's central dramatic action of "psychic testing," and invests his characters with self-conscious theat-

ricalism. A senecan emphasis upon personality as the last value in a disintegrating world sharpens the dramatic double vision which animates Webster's plays and merges with the ambivalent response to the Machiavellian doctrines of *virtù* and human evil.

Using revenge tragedy as vehicle for the expression of such pessimism, Webster presents the eternal search for justice (the central action of this *genre*) with irony. In The White Devil, his revengers are no better than those whom they destroy, and the denouement is morally ambiguous. In The Duchess of Malfi, the fiendish revenge of the Aragonian brothers emphasizes the injustice of a world built upon the power principle and affords Webster the opportunity to praise the virtues of stoic fortitude in the person of his Duchess.

More clearly demonstrating Webster's double vision is his fusion of satire and tragedy, in the tradition of Marston and Jonson. The heroic personalities of his characters are continually counterpointed by the satiric undercutting of Flamineo and Bosola. Thus, he is able to present his peculiar view of the world, combining his stringent moral criticism of Renaissance egoism and his instinctive admiration for the energetic glamor of his evil characters.

Webster's drama, then, is an artistic attempt to reconcile two seemingly opposed views, an admiration for heroic strength and a pessimistic recognition of prevalent evil. Using "metaphysical" verse, employing Senecan heroics, and fusing satiric humor with responses traditionally evoked by heroic tragedy, he presents his vision of a Manichean world, a vision similar in its violent distortions to the canvases of Tintoretto and El Greco. His plays, which are dramas of vision rather than naturalistic documentaries, are his theatricalized responses to the fears of a fragmentary and chaotic world.

454 pages. \$5.80. Mic 57-2485

CONTRIBUTIONS FROM DIDEROT AND GRIMM IN THE STOCKHOLM MANUSCRIPT OF THE CORRESPONDANCE LITTÉRAIRE (1760-1774)

(Publication No. 19,799)

Vincent Eugene Bowen, Ph.D.
University of Illinois, 1956

Students of eighteenth century French literature are well aware of a number of shortcomings which mar the printed editions of Grimm's Correspondance littéraire. The editions of Buisson (1812-1813) and Taschereau (1829-1831) are somewhat fragmentary, reflecting little system in their selection and rejection of material. In addition, neither editor discussed his source in any detail. The edition published by Maurice Tourneux (1877-1882), based principally on a manuscript copy from the Ducal library in Gotha, is the most complete to date. Despite the advantages it offers, however, the Tourneux edition does not always appear to be a faithful reproduction of the Gotha copy. Tourneux admitted having deleted a number of items which were present in the Gotha copy, but he trimmed and discarded other material with no acknowledgment. His methods have left the student with an indistinct idea of the extent of Diderot's contributions, and of the scope of the Correspondance itself.

The purpose of this study is two-fold: first, to determine as accurately as possible the extent and nature of Diderot's contributions to the Correspondance from 1760 to 1774; and secondly, to offer for the first time a number of critical notes by Grimm which served to comment Diderot's Salons in the Correspondance.

The basis for this study is a manuscript copy of the Correspondance which was sent to Luise Ulrike, the queen of Sweden. Despite certain lacunae, the Stockholm manuscript is felt to constitute a reliable basis upon which to study the articles submitted by Diderot for insertion in Grimm's journal.

A comparison of the Stockholm copy with the printed editions of the Correspondance reveals that Diderot's contributions were much more numerous than hitherto believed. The first half of the manuscript contains not only the Diderot items common to the combined printed editions, but a total of nineteen other works which are missing from the latter. Some of these writings are of minor importance, but others (Madame de la Carlière, the Supplément au voyage de Bougainville, and the Addition aux pensées philosophiques) figure among Diderot's best-known shorter works; two of the contributions have never seen publication. The presence of these writings in the Stockholm manuscript indicates how essential the Correspondance is to any serious study of Diderot.

The Stockholm copy also contributes substantially to the documentation on Diderot's Salons, especially to those of 1761, 1763, and 1765, which are complete in the manuscript. The Salons of 1767 and 1769, while represented in the Stockholm copy, are of less importance because of their brevity. Besides presenting texts which vary frequently and radically from the printed versions of the Salons, the manuscript is a rich source for the notes inserted by Grimm throughout Diderot's reviews. All of the notes offered in the present study are unpublished; they will be indispensable to any study of the relationship between Diderot and Grimm, and they should accompany the reviews in any future edition of the Salons.

Although the Stockholm copy represents only one of several manuscript copies sent to foreign royalty in Europe, it nevertheless casts new and significant light on the scope of the Correspondance. The present study thus permits us to redefine the pertinence of the Correspondance as an outlet for Diderot's thought.

347 pages. \$4.45. Mic 57-2486

SPRACHE ALS GESTALT IN GOETHES
BLANKVERSDRAMEN (LANGUAGE AS DRAMATIS
PERSONA IN GOETHE'S BLANK-VERSE PLAYS)

(Publication No. 20,665)

Sigurd Burckhardt, Ph.D.
The Ohio State University, 1956

If manner is matter and poetry is statement, then the manner of poetry states, minimally, something about the possibilities and limits of true speech. By speaking as he does, the poet says: "To be true and truly understood, I must speak as I do." What we call his "style" is, therefore, an assertion about the degree to which he judges ordinary human discourse--whether of his time or as such

--capable of containing and expressing truth. By the kind and degree of prosodic distortion to which he subjects his medium, common speech, he testifies to how and how far the latter vitiates, or has come to vitiate, its sole end: to make truth audible and communicable.

So considered, Goethe's verse plays--from the lyric fragments of his Sturm-und-Drang years to the masques of his old age--are a record of the exploration of his medium. Goethe set out with unbounded notions of the automatic validity of the creative word--the word of the Promethean poet. He ended with the ironic knowledge that the poet can indeed speak validly, but only by surrendering all claim and semblance of speaking directly to others, only by withdrawing into a verbal universe which is self-contained and not accessible except by indirection. But between naïve creative self-reliance and enigmatic irony, Goethe held and lost the faith that the poet can speak both directly and truly.

Of this stretch of his road, the three blank-verse plays --Iphigenie auf Tauris (1787), Torquato Tasso (1789), and Die natürliche Tochter (1803)--mark the stages. They can be read as a trilogy, with the institution, progress, and degeneration of human language as its unifying theme. Iphigenie celebrates the mythical moment when man, taking full responsibility for himself, abjures the protection of the ambiguous divine word as well as of the lie, stakes his life on speaking truly and being heard, and so finds a human community. Tasso, with its Renaissance setting, shows this community firmly established, highly civilized, and already committed to the dangerous belief that speech is no longer a personal risk, but an expression and ornament of social existence--no longer the continual re-creation of a purely personal union, upon which all larger social structures must lastly rest, but the pleasant and convenient by-product of an order which rests secure in itself. The consequences of this belief propel the tragic action of Die natürliche Tochter, which takes place on the eve of the French Revolution and shows the state corroded by deception and intrigue. Language--first the founder of the community, then its highest expression--has now become a tool, no longer "true," but effective in proportion to the power and skill of its user. True communion is no longer possible, and the social order, so deprived, disintegrates.

With it disintegrate the "form" and "style" of the blank-verse play in Goethe's poetic work; for their assertion--that the poet can speak the language of men directly and truly--has proved false. At least in the poet's time and place this language necessarily falsifies and is necessarily misunderstood. Goethe from now on had to speak in riddles and parables, not only of story, but likewise of syntax, meter and image, if--in a wholly parabolic world--manner was to remain matter.

276 pages. \$3.55. Mic 57-2487

ROBERT FROST, AMERICAN SYMBOLIST:
AN INTERPRETIVE STUDY
(Publication No. 21,554)

Charles Henry Cook, Jr., Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Edward Wagenknecht

The aim of the present study is to discuss the sense in which Frost may be termed a symbolist and to demonstrate the validity of the symbolic approach in the interpretation of individual Frost poems and of the poetry in toto. Frost's artistic premises show that he advocates art for wisdom's sake, not (like most "Symbolistes") art for art's sake. He is a symbolist in the Emersonian or American tradition.

In Frost's earliest works, the two dominant symbolic themes are the withdrawal and sic transit motifs. The dominant symbols are the dark wood (complicated and dynamic in implication) and miscellaneous emblems of mortal decay. North of Boston seems a conscious reaction from the subjectivity of the earliest work toward a gregarious opposite. The introductory poem, "Mending Wall," establishes the symbolic wall-motif which dominates the collection. Mountain Interval and New Hampshire provide the first prominent manifestations of the poet's artistic maturity, but the culmination toward which the early books have been tending seems to arrive in West-Running Brook. Frost utilizes his constant symbols to emphasize man's sense of weakness in an inimical universe. The human response to this condition is treated symbolically in the poem "West-Running Brook." The black stream, symbolizing the universal course of mortal decay, is met by a strange resistance in itself, a resistance which kicks up a white wave in the contrary direction.

The late works, including A Further Range, A Witness Tree, and Steeple Bush, intensify Frost's concern over spiritual problems. The aging poet repeatedly intimates his sense of time's passage. Utilizing the dark-wood symbol in combination with other symbols, he expresses more fully his concept of the self and his recognition of the importance of introversion.

The two symbolic masques sum up Frost's thinking on the leading concerns of his life: the problem of evil and the pursuit of spiritual fulfillment. Reason declares the total unreason of suffering, the reality of evil, and the impossibility of successfully rationalizing Satan out of the picture. Mercy questions how man should order his life in a universe of moral irrationality and inescapable evil. Since man cannot meet the standards voiced in the Sermon on the Mount, man is inevitably destined to failure and sin. The universal irrationality is such that even one's best is not enough. Since all must fail, the only hope lies in love and its active agent, mercy. The key symbol of Mercy is an oublie, a device related to the dark wood.

The only conclusion possible, in the light of a careful study of the symbolic implications of Frost's complete works, is that Frost has tended, from the beginning of his career, toward a broadly Christian view of man's relationship to other men and to God.

Expressing himself largely through symbols, Frost intimates that reason, which may be useful in minor ways, is worthless in dealing with the great moral and spiritual issues. Christ came to bring about the grand break with

reason and logic, and to demonstrate (as we learn in Mercy) by his preaching and his own fate that reason and justice are pathways to despair. The hope lies in love and mercy.

341 pages. \$4.40. Mic 57-2488

THE AMERICAN NOVELIST INTERPRETS
THE STUDENT OF HIGHER EDUCATION

(Publication No. 16,973)

Ruth Bell Gober, Ed.D.
The University of Oklahoma, 1956

Chairman: Professor Frank A. Balyeat

This is a study of the student in American colleges in recent years, as portrayed in American novels published since 1920. The student is shown in relation to his environment, his fellow students, his instructors, his studies, and his extra-curricular life.

From examination of annotated bibliographies of American novels published in the twentieth century, five novelists were selected as best portraying the college student. Only those novels were chosen in which a student was cast in a major or a significant minor role. Three major areas were explored: the identification of the student of higher education; the educational experience, both basic and incidental; and the evaluation of the experience of higher education.

Because the interpretation of the students in the novel reflected, at times, the experience of the writer, consideration was given to the life span of the five writers chosen: F. Scott Fitzgerald, 1896-1940; Willa Cather, 1873-1947; Sinclair Lewis, 1885-1951; George Santayana, 1863-1952; and Thomas Wolfe, 1900-1938.

All five of the writers had experienced higher education; three of them were teachers. Their interpretations of the college students were enriched by their two-fold experiences as student and teacher.

This study opens and closes with the interpretation of the college student who lived in a restless world of international tension. The novelist revealed his awareness of the impact of the times on the life of the students. They came from rural areas, villages, and cities. Colleges attended included those with enrollments of only a few hundred as well as those with several thousand.

College education afforded the student an opportunity to meet other students of approximately his own age, to associate and study with them, and to make the transition from adolescence to adulthood more satisfactorily. He had an opportunity to become better acquainted with himself and to discover his strengths and his weaknesses. While maturing intellectually and socially, he had an opportunity to learn the fundamentals of a vocation. In an effort to find his place among his fellowmen, he underwent many frustrations and difficulties. He better learned to understand others as well as himself.

These authors indicated a close relationship between the student and his environment, as well as with the times in which he lived. Always there was the relationship to other individuals. Cognizance was taken of the many problems which the student met in the life which followed classroom experience.

These five novelists reveal the interpretation of the satirists, the seekers, and the affirmers of the values of higher education. They mirror the weaknesses and the strengths of higher education.

212 pages. \$2.75. Mic 57-2489

TROPES AND FIGURES: A PSYCHOLOGICAL STUDY OF DAVID HENRY THOREAU

(Publication No. 21,762)

Raymond Danta Gozzi, Ph.D.
New York University, 1957

Adviser: Professor Gay W. Allen

The title of the dissertation, "Tropes and Figures: A Psychological Study of David Henry Thoreau," was chosen to emphasize this work's concern with figures of speech and its aim to see the person who was given the names "David Henry" more than the person who chose to reverse the order of these names. Not presented as a complete psychological study taking into account all influences on Thoreau or all sides of his personality, it offers a speculative Freudian interpretation that contrasts with and supplements Thoreau's self-image and the images made by his biographers.

More particularly, it studies Thoreau's early life, his father, mother, and brother, and his relations to them; his friendships with Ellery Channing and the Emersons; his response to John Brown; his death. Various aspects of his personality are also considered, as well as his relations to religion, the state, and nature. Thoreau as a neurotic with an unresolved oedipus complex is given main emphasis. He is seen as unconsciously fixated on his mother, dominated by ambivalent feelings toward both his parents, psychologically castrated and incapable of a mature sexual relation. He is studied as a compulsive personality and as a person for whom success was destructive. His egoism, aggression, and great powers of rationalization, projection, and identification are also discussed.

Thoreau's early life left him basically insecure. Various traumatic experiences seem reflected in numerous passages of his writings. His repetitive childhood dream of the Rough and the Smooth appears to express fear of his father and love of his mother, and his youthful--and later--mystical experience suggest momentary unconscious feminine identification and abatement of father-hostility. A number of these experiences, which total about a half dozen, are connected with his sense of hearing, which was extraordinarily libidinized; his interpretations of several are non-theological.

Never leaving Concord except for short periods, he spent his life essentially as a home-bound and dutiful son. Nature-love was his displaced expression for his unconscious mother-love. Hostility for the state and organized religion gave displaced expression largely to his unconscious hatred of his father.

Thoreau was a more sickly and unhappy person than is generally recognized. Unconscious castration-anxiety is evident in his need for wildness, his response to trees, and in various episodes of his life. Never maturing psychologically, he was adolescent in many ways; his significant

emotional ties were with men or with women who were mother-figures.

He transferred his unconscious feelings for his parents to the Emersons. The "Sister" manuscripts probably reveal his love for Mrs. Emerson. Identifying so closely with Mr. Emerson as to astound numerous observers, he had ambivalent feelings for him, a father-figure, which are traced at length.

Tremendously restless after his father's death in February, 1859, Thoreau, through identification with John Brown, released aggression against the parental state. The retaliation of the state against Brown (death by hanging) Thoreau seems to have experienced in different form when his final illness started--one year to the day after he says he heard of Brown's death. Participation in political matters, it is suggested, released in Thoreau massive aggression which he could not handle, which was self-destructive. Nature-relation gave him pleasure and release-in-art; it was his special route to salvation.

485 pages. \$6.20. Mic 57-2490

**TANCRÈDE DE VISAN.
AN INTELLECTUAL BIOGRAPHY.**

(Publication No. 21,636)

Russell G. Grenon, Ph.D.
Columbia University, 1957

The purpose of this study of the life and works of Tancrède de Visan (1878-1945) is to examine for the first time his literary position as a critic of symbolism, as a poet, and as a regionalist-traditionalist.

Symbolism is often considered antipathetic to tradition, but Visan felt that it was a vital continuation of the main current of French literature. He was also the very first to attempt to demonstrate that Henri Bergson's *Essai sur les données immédiates de la conscience* corresponds on the metaphysical plane to the empathic vital force of symbolist lyricism. The present work analyzes his critical essays on Bergsonism and the symbolists, on the peripheral vision of the Parnasse as contrasted with the central vision of symbolism, on German romanticism and the symbolist manner. Likewise it examines his contributions concerning Paul Fort, Francis Vielé-Griffin, Henri de Régnier, Emile Verhaeren, Maurice Maeterlinck, Robert de Souza, Albert Mockel, and André Gide. Most of them appeared as articles but were published in book form (1911) as *L'Attitude du lyrisme contemporain*. Visan, it is shown, seeks to prove that all of these men of the generation of 1885 are imbued with similar artistic propensities which taken together may be called symbolism. Each of them, however, retains his particular personality and manifests the symbolist attitude in his own way.

Visan's own poetry exemplifies this binary constitution of the symbolist's art. But with Visan, the independent and personal factors are very much in evidence. The symbolist element in his poetry is far less conspicuous than in most of the works he writes about as a literary critic. Yet the Bergsonian ingredients -- which for Visan are equated in their substructure with symbolism -- the quest of the Absolute, the pre-occupation with the infinite, and certain formal qualities, make for an overall symbolist posture.

This mingling of the intuitive and the subliminal on the one hand, with the Platonic, the Biblical, the Roman Catholic, and the purely intellective on the other hand is carefully scrutinized in Visan's two collections of poetry, Paysages introspectifs and Le Clair matin sourit.

Complementing this ideal poetic aspiration is his philosophy of action shown to be centered about regionalism and traditionalism. For Visan this is synonymous with Roman Catholicism, intense nationalism, and lineal continuity. His prize-winning novel, Sous le signe du lion, is a study of Lyon and the Lyonnais. It was published in 1936 and urges the people of France to return to these principles which he claims have been France's glory. A further consideration is made of his affinities with such men as Paul Bourget, Maurice Barrès, Charles Maurras, and the Comte Arthur de Gobineau whose writings he lauds and comments upon at some length.

There is also a treatment of the important aspects of Tancrède de Visan's life from the Parisian Vers et Prose, Closerie des Lilas days through the post-war Lyonnais period insofar as they relate to his literary production as poet, symbolist critic, and exponent of traditionalist-regionalist beliefs. 182 pages. \$2.40. Mic 57-2491

EUROPEAN ROMANTIC IRONY

(Publication No. 21,607)

Morton L. Gurewitch, Ph.D.
Columbia University, 1957

The phrase "romantic irony" makes extraordinarily little sense in most critical contexts. So far as German literature is concerned, "romantic irony" has designated either the poetic irony theorized about in the fragments of Friedrich Schlegel--a largely retrospective irony, never dubbed by him "romantic"--or, erroneously, the fantastic comedy of Ludwig Tieck. When not restricted to a purely German reference, the expression "romantic irony" has been used to describe, without any synthetic enrichment of meaning, nineteenth-century writers who happen to display both romantic and ironic traits.

This dissertation aims to supply romantic irony with fresh significance and a broader scope. Chapter I clears the way for such an attempt: it investigates the classically ironic temper, differentiates between the sphere of irony (the absurd) and that of satire (the ridiculous), surveys the major types of recognized literary irony, and concludes with a psychological and philosophical approach to the "status of gay desecration."

The first part of Chapter II takes up the vexed problem of "German" romantic irony, and manages to construct a bridge to the spiritually more relevant "European" romantic irony practised, in varying degrees, by Byron, Carlyle, Leopardi, Musset, Gautier, Stendhal, Büchner, Heine, Baudelaire, and Flaubert. The second part of this chapter analyses the influence of the closely observed "absurd theatre of history" upon the making of romantic irony.

Chapter III makes clear that the identifying mark of the romantic ironist is his simultaneous commitment to exalted visions and to a renegade impulse which mockingly dissolves them. The romantic ironist is inspired by a romantic animation, yet at the same time he surrenders

to an anti-romantic animus. He is both ecstatic and coldly depreciative; he is at once lyrical and astringent. A study is made in this chapter of those works of the romantic ironists which embody an inextricable celebration and disenshrinement of romanticism, or that attempt to reduce romanticism to the condition of farce, lunacy, or disease.

Chapter IV analyses the romantic ironist's technique of interlocking Innocence and Experience. Innocence (except for Baudelaire, whose Innocence is touched with a spiritual cosmetics) is taken to connote romanticism, exaltation, idealism, or transcendence; Experience suggests anti-romanticism, disillusion, absurdity, or decadence (transcendence and decadence are Carlyle's terms). Through the study of themes, characters, and organic structures, this chapter shows how the blended Innocence and Experience of romantic irony, arising from a profound ambivalence of temper, differs from the ordinary shift from the naive to the nihilistic or from the sublime to the ridiculous.

Chapter V traces the tendency in romantic irony to metamorphose the absurdity of exaltation into the exaltation of the absurd. Witness especially Leopardi, Büchner, Heine, and Baudelaire. While both the classical and the romantic ironist see life as a laughable tragedy or a noble farce, the vision of the absurd which the romantic ironist perceives is more penetrating than that of the classical ironist, if only because the former brings to his mockery a greater measure of fervor. The romantic absurd lends to the mingled terror and jest of the universe a more haunting abortion of the ideal or a more powerful tragic-comic purgation of the emotions. (It is necessarily through the emasculation of tragedy that the absurd gains its ascendancy, provided that the failure of the tragic will and the tragic imagination be accompanied by a sense of diabolical hoax.) The last pages of this chapter review the elements that make for the peculiar insights and techniques of the romantic ironist. 247 pages. \$3.20. Mic 57-2492

WILLIAM DEAN HOWELLS: SOCIAL COMMENTATOR

(Publication No. 21,570)

Robert Lee Hough, Jr., Ph.D.
Stanford University, 1957

William Dean Howells, the father of literary realism in America, played an important part in social reform in the United States from 1885 until 1920. Though not as original or sharp-tongued as other social critics, he dealt with significant aspects of reform (public employment, women's suffrage, state ownership of basic resources, American imperialism, among others) both in his novels and magazine articles. Moreover, he was ideally situated, as the writer of the "Editor's Study" from 1886 to 1892 in Harper's Monthly and the "Editor's Easy Chair" from 1900 to 1920 in the same magazine, to promote the works of other social critics with whom he agreed. In a sense, he became the publicist for such American liberals as Richard Ely, Robert Herrick, Hamlin Garland, and Henry Lloyd and such European critics of industrialism as William Morris, Armando Palacio Valdes, and Henrik Ibsen. Because of his personal reputation and the nature of the

magazines for which he wrote, Howells undoubtedly reached a segment of the population not open to every reformer.

Born in rural Ohio in 1837, Howells was raised in Mid-western farming communities where "nobody was rich, nobody was in want," and it was in the name of this earlier and, as he saw it, more democratic America that he protested against the changes caused by industrialism. He deplored the growing class divisions, the slums, the labor conflicts, and the fact that the American ideal had passed from the man of culture to the man of wealth. He believed that the concept of equal opportunity for everyone was impossible in a *laissez-faire* capitalism.

Though Howells' best-known social writings were done in the 1880's and '90's, he did not turn away from social commentary after the collapse of the Populist Revolt in 1896, as some scholars believe. He continued to express, particularly through the "Editor's Easy Chair," discerning remarks on aspects of American society. Never a systematic organizer of reform, he became a gadfly of liberalism after the turn of the century with comments on subjects ranging from prison reform to compulsory arbitration to international government, and his main goal, that of greater government participation in economic matters, emerged in the stream of reform that accompanied the New Deal.

242 pages. \$3.15. Mic 57-2493

MACHADO DE ASSIS AND THE BOOK OF ECCLESIASTES: INFLUENCES, REMINISCENCES AND PARALLELS

(Publication No. 20,248)

Sister M. John Berchmans Kocher, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Lloyd A. Kasten

The present study represents the first attempt to examine in detail the influence, long generally recognized, of the Book of Ecclesiastes upon Machado de Assis.

Direct citations from Ecclesiastes indicate that his influence persists throughout Machado's entire literary career, beginning with the latter's early dramatic pieces and ending only with his final work, the novel, *Memorial de Aires*. Indirect expressions of Ecclesiastes' views on the part of Machado are likewise numerous.

The influence of Ecclesiastes upon Machado's verse and non-fictional writings in prose is multi-faceted, being evident in the various aspects of his concept of time, in his attitude toward death, and in his outlook upon the problem of evil and the philosophico-religious notions relating thereto. Ecclesiastes' views on time as effecting change have also been incorporated into Machado's thinking relative to the progress and development of the literary artist. Machado's adoption of the artistic posture of the humorist similarly finds its *raison d'être* in the pessimistic world-view he shares with the Preacher.

The analysis of Ecclesiastes' influence upon Machado's creative works of fiction has been limited purposely to the three novels, *As memorias posthumas de Braz Cubas*, *Dom Casmurro* and *Memorial de Aires*, which represent most clearly the parallel development that occurred in the outlook of both Machado de Assis and Ecclesiastes, from ni-

hilistic pessimism through an attitude of resigned acceptance toward the evils of life to a final viewpoint attained in old age, wherein a nostalgia for living predominates over pessimism.

In the *Memorias posthumas*, the futility of existence is artistically portrayed through the figure of the protagonist, Braz Cubas. His self-defeating life of a pleasure-seeker offers a characterological justification for pessimism that parallels in detail Ecclesiastes' depiction of the vanity of his own search for happiness in the pursuit of pleasure. Braz' serious cogitations--fittingly made by him only in a state of delirium--reflect, on the other hand, Ecclesiastes' views on the inability even of the seeker after wisdom to discover the meaning of human destiny.

In *Dom Casmurro*, Ecclesiastes' notion of time as the agent of destiny in effecting man's inevitable disillusionment through experience is given expression. The bitter pessimism of *Braz Cubas* is now succeeded by an attitude of resignation to disenchantment.

Memorial de Aires, a novelistic apologia of private life, expresses Machado's concurrence with Ecclesiastes' practical philosophy, namely, that the only genuine satisfactions redounding to man are those gained in the pursuit of his work and the enjoyment of the simple pleasures of domestic life. The novel, largely autobiographical in character, also invalidates the notion of the supposed incompatibility existing between Machado's life and works, by showing how his speculative views, like those of Ecclesiastes, find their complement in his practical outlook.

308 pages. \$3.95. Mic 57-2494

THE ARGENTINE NOVEL IN THE NINETEENTH CENTURY

(Publication No. 21,611)

Myron Lichtblau, Ph.D.
Columbia University, 1957

The purpose of this dissertation is to study the origin of the Argentine novel and its development in the nineteenth century. Comprehensive in scope, the work examines the various stages through which the novel passed, considers both the major and minor novelists, and appraises the literary merit and importance of their works. Before revealing this process of fictional growth, however, the dissertation treats of significant features of Argentine civilization and the environment in which the writers produced their works.

The beginnings of Argentine fiction are found in several prose works of the 1830's, 1840's, and 1850's, which evince in embryonic form definite novelistic tendencies. Yet it was only after political freedom and relative stability had been established with the defeat of the dictator Rosas in 1852 that the Argentine novel truly emerged. The first full-fledged novel, *Amalia* (1851), and the other novels of similar mold that immediately succeeded it, were born of firm political motives, of an intense hatred of a brutal government. Although this robust romanticism of *Amalia* represented one of the most significant kinds of romantic fiction, other types appeared as well. The romantic novel in Argentina displayed many facets and included works of exalted passion and exaggerated sentiment, stories of

foreign setting, like Miguel Cané's *Esther*, and narrations of the mysterious, supernatural, and legendary, as seen in the production of Juana Manuela Gorriti.

The decade of the 1870's opened up new vistas in fiction. The romantic novel, although still to appear in this and subsequent periods, had run its major course during the 1850's and 1860's. Argentina in the 1870's showed definite signs of rapid development, but as yet the changing picture of the country---in particular Buenos Aires---did not come into sharp enough focus to provide material for novelistic purposes. The new themes which appeared in the fiction of the 1870's dealt with scientific and pseudo-scientific phenomena, with crime and its social implications, and with the nation's small indigenous element.

With Eduardo Gutiérrez' creation of the gaucho novel in the early 1880's, the Republic received a distinctively Argentine form of fiction. In these gaucho works, and in many other novels of equally violent action, Gutiérrez captured the attention of a wide public and awakened in his countrymen a desire to read the national novel.

A tremendous surge in novel writing occurred during the 1880's and 1890's, a period that witnessed great material progress and economic growth. As this vital transformation took place, eager writers like Lucio Vincente López and José María Miró sought to mirror faithfully that rapid change and portray the new Argentina that was arising. It is thus seen that Argentina itself, particularly the energetic and expanding capital of Buenos Aires, provided the engaging raw material for the realistic novel that developed to full stature during these two decades.

Flourishing side by side with realism in Argentine fiction was the current of naturalism, with its adherence to the tenets of determinism and its emphasis on the more sordid and wretched aspects of life. For the naturalistic writers, outstanding among whom was Eugenio Cambaceres, Argentina's extraordinary material advancement during the 1880's and 1890's brought about a vast network of social evils and unhealthy, distorted attitudes and modes of behavior.

Varied and richly expressive of the Republic's pride in its national distinctiveness and fundamental worth, the Argentine novel of the nineteenth century may be understood in its totality as a meritorious literary record of the country in the process of development. Indeed, it stands as the important and noteworthy opening chapters in the continuously advancing story of Argentine fiction.

375 pages. \$4.80. Mic 57-2495

A CRITICAL BIBLIOGRAPHY OF EUGENE O'NEILL

(Publication No. 21,643)

Jordan Yale Miller, Ph.D.
Columbia University, 1957

In 1956, the production and publication of *LONG DAY'S JOURNEY INTO NIGHT*, together with a successful revival of *THE ICEMAN COMETH*, brought renewed interest in the plays of Eugene O'Neill. At the same time, they sharply emphasized the decrease in O'Neill's popularity which had become evident during the preceding twenty years. After 1934, O'Neill, as dramatic artist and literary figure, went into an abrupt and prolonged decline. *THE*

ICEMAN COMETH in 1946 and brief revivals of earlier plays emphasized the lack of public enthusiasm.

The causes of O'Neill's disappearance for almost a generation can be found in a study of the extensive material assembled in the more than four thousand entries of the Critical Bibliography which forms the bulk of this present work. It reveals these four main factors which unite to show that, despite critical, popular, and financial success, O'Neill, in his lifetime, was ultimately a failure.

1. O'Neill remained virtually unknown to the public that supported his plays, and always somewhat of an enigma to those who knew him as a personal friend. He wrote virtually nothing outside of his plays; he consistently refused to appear in public; and he would not attend his own opening nights. There is no completely successful biography, and his personal papers in the large collection at Yale are restricted from public inspection. All published items, whether by personal friend or professional journalist, reveal only that he wished to be alone and to be let alone.

2. O'Neill's overt theatricality in the use of sound, lighting, decor, dialogue, costume, and character drew praise and condemnation throughout his career, yet he was never able to bring his artistic style into any consistent form. He exhausted his vein of originality as he lavished one new sensation after another upon successive plays, eventually reaching a point where he could no longer command an audience.

3. Both in body and in spirit, O'Neill was continually isolated from the audience for which he wrote. He never lived within easy access of New York, and he detested all kinds of personal publicity. As he continued writing tragedy in the midst of economic prosperity, severely condemning the materialistic madness of his own society, concerning himself with man's relation to God, he failed to write "in the spirit of the age." As a result, his audience became increasingly unable to understand the message he attempted to bring.

4. Finally, O'Neill eventually surrendered to a type of sentimental romanticism which had always been an undercurrent in his work, but which had, in his earlier plays, been forcibly controlled by the conscious destruction of his sensitive, romantic protagonists. By the end of his active career in 1934, he had turned to the popular romantic view of small-town living, and to the church, while at the same time he lived his own secluded life in surroundings of the most conventional romantic nature -- an ancient French chateau, a Georgia home with a study built to resemble a seagoing captain's cabin, and an isolated California valley in a Chinese-style mansion.

756 pages. \$9.55. Mic 57-2496

EVOLUTION OF MYTH IN THE PLAYS OF W. B. YEATS

(Publication No. 21,644)

John Rees Moore, Ph.D.
Columbia University, 1957

Starting with a summary of Yeats' conceptions of theater and its uses, and a consideration of myth as both a social institution and a source of artistic inspiration,

this study attempts to show--in a particular case, the plays of Yeats--how myth can serve the poet as an organizing principle in his work and as a framework for his vision of reality.

An analysis of the plays from The Countess Cathleen to The Green Helmet reveals Yeats as an experimenter in search of subjects and forms which will best express certain preoccupations that underlie his work from beginning to end: What makes a hero (a heroine)? How is the hero set apart from ordinary men? What sacrifices are demanded of him? How does he achieve success (or failure)? In On Baile's Strand and Deirdre Yeats is most successful in finding a dramatic medium for his answers.

But his plays failed with the Abbey audiences, and when Yeats turned to drama again with his Plays for Dancers, he experimented with a form stricter in its demands on the audience, more allusive and subtle in its poetic technique --in fact the plays are designed for a drawing room and not for the public theater. In their use of imagery, masks, dancing, and choral musicians they owe something to the Noh plays to which Ezra Pound had introduced Yeats.

The Player Queen, Yeats' most ambitious attempt at comedy, is a playful exemplification of the doctrine of the mask as Yeats formulated it in the Essays and elsewhere. It shows his preoccupation with the theme of transformation as it affects poetry, politics, and even sexual relationships, and in its emphasis on a fabulous historical perspective where both social and individual change depend on a kind of imaginative revelation the play provides a link with the later work from The Resurrection to The Herne's Egg, where Yeats works out a myth of the "eternal" pattern beneath historical change.

In these plays Yeats explores the conflict between an other-worldly ideal, often symbolized as chastity, and a passion that is both destructive and creative, frequently symbolized by the sexual act. Purgatory is the climax of Yeats' dramatic achievement, for here at last he dispensed with everything but the bare essentials: an old man who contains within him the extremes of a vision of grandeur and the reality of passionate despair, a boy who is the old man's foil and conscience, a tree and a house which symbolize, among other things, organic life and history. It is a tragedy of human failure to live up to an heroic ideal.

The study concludes with a view of Yeats' career as a playwright and an examination of his use of such ritual elements as the restoration of fertility, and initiation of the hero, the assumption of a pattern of cyclical repetition underlying history, the insistence on the necessity of sacrifice, the feeling for the sacredness of certain places, and the striving toward union with a god or godlike power. But the plays create a myth of failure; the sense of a unified community which reaffirms its solidarity through ritual is gone, and the isolated Yeatsian hero, denied by his society and deprived of his primitive ritual function, becomes finally an old man powerless to reinvigorate his community or to save himself from death or madness.

260 pages. \$3.35. Mic 57-2497

ALCIDES ARGUEDAS: CONTEMPORARY BOLIVIAN WRITER

(Publication No. 21,615)

Mary Plevich, Ph.D.
Columbia University, 1957

Although the work of Alcides Arguedas constitutes an important contribution to the contemporary novel and essay of Latin America, it has been the object of much controversy within Bolivia and has not received the recognition that it deserves.

The literary production of Arguedas forms a complete and well-integrated unit. All of his works, including his first literary attempt Pisagua (1903) have as their main theme: Bolivia. Wuata-Wuara (1904), a novel of the land, may be considered the embryonic form of the more amplified and artistic work Raza de bronce (1919) which, together with Vida criolla (1911), a novel of the city, present a vivid picture of Bolivian life at the turn of the century. In these works of fiction, the novelist describes the plight of the Aymara Indian and "caudillismo", two of the many problems discussed in Pueblo enfermo (1909), a penetrating and pessimistic study of national affairs. Then, in Historia de Bolivia (1920-1929) he gives further proof of the seriousness of these problems, relating them to the activities of the "caudillos" and their administrations. In his last work to be published, La danza de las sombras (1934), Arguedas again stresses the political aspect, in dairy form. All of these works were written with one purpose in mind: to awaken the national consciousness in order to foment the regeneration of Bolivian spirit and strength.

Arguedas' main contribution to Spanish American literature lies in the novel. As the author of Raza de bronce he is the first "Indigenista" novelist to be preoccupied with the Indian as a social problem without sentimentality, thus, bringing to a close the epoch of romantic "Indianista" fiction. Arguedas presents a dark and depressing picture of the life of the Aymara Indian who is at the mercy of the white man, the "mestizo" and the natural environment. For the first time in Raza de bronce, the dual aspect of nature is emphasized, i.e., the poetic qualities of the national landscape and nature as a destructive sociological force. This Bolivian novel embodies characteristics which later come to the fore in such works as: La vorágine by Rivera, Don Segundo Sombra by Guiraldes and Doña Bárbara by Gallegos, all published after 1919.

Arguedas achieved international recognition and fame for his essay Pueblo enfermo. Although he counted among his friends many modernist essayists of the Rodó school, Arguedas was not concerned with the destiny of the South American continent or preoccupied with the imperialistic tendencies of the United States. His work was completely national or nationalistic in scope: he limited his observations to Bolivia in an effort to discover why his country was a backward nation. As a result of his analysis, he concluded that the "mestizo" was to blame for the ills of the nation, and although he implied that the future of Bolivia depended on the Aymara Indian, he had little faith in the Indian's ability to be a dynamic force in the renaissance of the country. Because of the pessimistic and negative aspect of his work, Arguedas was charged with the creation of the black legend of Bolivia. Thus, Pueblo enfermo gave rise to numerous controversies and stimulated

the publication of studies on national affairs. Even today the name of Arguedas provokes polemic in Bolivia where reference is still made to the "leyenda arguedista" and "arguedismo". Furthermore, in other Latin American countries, works of a deeply pessimistic nature about one's nation began to appear, indicating the far-reaching influence of the Bolivian's work.

The last work of importance written by Arguedas was *Historia de Bolivia* which gave him the distinction of being the first eminent contemporary historian of Bolivia. As a result of his untiring efforts to obtain data, he was able to write an informative account of the development of Bolivia, beginning with its creation as a nation in 1825. Of the five volumes published, the last, entitled *Los caudillos bárbaros* constitutes the point of culmination in the series. Melgarejo and his activities, as presented by Arguedas, seem incredible, befitting a fictional character portrayed in a novel of intrigue and crime. By reconstructing conversations and including speeches, anecdotes and personal letters, Arguedas wrote a history of Bolivia which is colorful and palpitating with life.

Approximately ten years have passed since the death of Alcides Arguedas. It is a propitious time to bring to the attention of the literary world the works of one of the leading figures of Spanish American letters.

204 pages. \$2.65. Mic 57-2498

FLAUBERT'S SOCIAL ATTITUDES IN RELATION TO HIS ARTISTIC THEORIES

(Publication No. 20,884)

Ellis Gibson Porter, Ph.D.
University of Illinois, 1957

This study represents an attempt to define the character, origins and manifestations of Flaubert's attitude toward society, and the effect of this attitude upon the formation of his artistic doctrines.

His personality was essentially formed by the end of his adolescence, and changed very little after that time. With the help of his *Correspondance* and of his *Oeuvres de jeunesse*, we have examined various sentiments and ideas, developed during his youth, which continued to dominate him in later life.

We have also studied various external influences which helped to determine his permanent detachment from society. His feeling of isolation resulted, in part at least, from the remoteness of his father, the antagonism of his schoolmates, and his inability to realize the *grande passion* of which he dreamed. His attitude of extreme individualism was intensified, moreover, by the influence of Romantic literature and by his nervous disorder. This illness, to which he refers as the natural culmination of his unhappy adolescence, caused him to withdraw more than ever into a private world of dreams, self-analysis and literary creation.

His misanthropy was largely a reaction to the antipathy which he believed he inspired in others because he was "different" and "superior." He intensely disliked the bourgeoisie, by which he meant not so much a certain social class as a state of mind, that of the mean and petty materialist who was well-adjusted to society and who was

resentful of all individuality and superiority. On the other hand, he sympathized with exceptional individuals who, like him, were not accepted by the Philistine, and with groups which were hated and persecuted because they did not conform to the Philistine's conception of respectability.

Flaubert detested bourgeois complacency and self-assurance, which contrasted profoundly with his own lack of self-esteem and self-confidence. He could achieve a sense of his own worth only through dedication of his life to artistic endeavor. Art, for him, was a substitute for religion, for it was a means of justifying and of redeeming a life which, in many respects, he considered a failure.

He was only superficially an impersonal writer. Although seemingly objective, his novels enabled him to achieve catharsis through their implicit expression of his frustrations. His literary theories depended upon the fundamental idea that the presence of the author should be dissembled from the reader. While Flaubert's concern for truth and beauty was the ostensible reason for his insistence upon this notion, he was impelled to this partly by his need to conceal his highly sensitive person from an unsympathetic public. The discipline of impersonality was most difficult for him to observe, because of his admiration of lyricism in the works of the greatest authors, and because of his natural tendency to relieve his personal unhappiness by giving it expression in his works. Thus it was that his attempt at impersonality was only superficially successful.

Flaubert believed that the moral value of art lay in the exaltation of the soul through beauty. In his opinion, mere *reportage*, as used by contemporary Realists, automatically excluded the attainment of beauty. Despite his own copious use of observation and documentation, he did not believe that they were of value in themselves, but only insofar as they provided material for literary creation. The primary factor in the production of beauty was the vast effort of stylistic creation, by which the *données* of reality or of the imagination could be transmuted into art. This is the essential purpose to which he dedicated his life.

436 pages. \$5.55. Mic 57-2499

HERMANN BAHR AS A LITERARY CRITIC: AN ANALYSIS AND EXPOSITION OF HIS THOUGHT

(Publication No. 21,582)

Robert Edward Simmons, Ph.D.
Stanford University, 1957

The literary histories have labelled Hermann Bahr a *Proteus* or a *Verwandlungskünstler* and they dispose of his work in a few sentences. While granting his skillful use of dialogue and the inimitable Viennese atmosphere which he gave to his plays, the histories term these works impressionistic or decadent and dismiss them from consideration. As a critic he is remembered for his manifesto concerning the overthrow of Naturalism and for his discoveries of new talent in all artistic fields. In studies of Bahr's critical works the emphasis has been placed upon his dramatic criticism, although recently his social criticism of the twentieth century--particularly his indictment of the Austrian political system--has received attention. This dissertation concentrates on Bahr's literary criticism,

with special attention given to his early books of essays in order to trace the development of his artistic and critical principles from the last decade of the nineteenth into the twentieth century. After the turn of the century his aesthetic did not essentially change. Moreover, at this time he began to devote more time to general cultural criticism and internal political problems in Austria, as well as increasing his theatrical activities. This dissertation studies the peculiar blend of positivism with metaphysics, of the objective attitude of the natural sciences with a subjective belief in eternal values, which comprises the critical attitude of Hermann Bahr. A constant search for truth was the theme of his life, and his synthesis of the good, the true, and the beautiful in an artistic and cultural entity is derived from his essays and presented in this work.

160 pages. \$2.10. Mic 57-2500

A STUDY OF THE TENSION BETWEEN CHRISTIAN AND CLASSICAL TRADITIONS IN SEVENTEENTH-CENTURY POETRY

(Publication No. 20,536)

Harold Roland Swardson, Jr., Ph.D.
University of Minnesota, 1956

The body of this thesis consists of four essays treating the poetry of Herrick, Herbert, Marvell, and Milton from a common perspective. This perspective, developed in the introduction, makes use of certain obvious features of the conflict between Christian and classical traditions in Western civilization, a conflict generated originally by Christian suspicion of things pagan but extended to include many characteristics of poetry in the primary Renaissance literary tradition. The cause for discomfort on the part of a Christian poet writing in this tradition is that, in the Christian view, poetry developed along classical lines is, though esthetically attractive, both bad and false - - "bad" for its sensuous and worldly quality, associated with its pagan origins; and "false" for its source of inspiration outside the recognized springs of truth, the Hebraic "fountain of light." It is, at bottom, this Hebraic insistence on an exclusive revelation of the way, the truth, and the light that makes for the conflict.

Rather than treat the psychological manifestations of this discomfort in the poets themselves, or trace the prose controversy over the issue, or even document the evidence of the conflict in the poetry of the period for statistical generalizations - - all worthwhile approaches - - I choose here to examine the artistic consequences in the poetry itself. The historical background of the conflict is treated summarily here merely to bring it into focus for critical purposes. The result is not an argued conclusion as much as it is an exhibit of the usefulness of a critical perspective in understanding a selected group of good poems.

Such a perspective is naturally concerned with imagery, and part of the problem is to assess the evocative value of certain kinds of Christian and classical reference against the background of the whole conflict. This requires attention to such recurring contrasts as the crown of bays and the crown of thorns, Venus' sparrows and Christ's dove, the hill of the Muses and the Mount of Olives, etc. It is necessary, for example, to investigate the use of classical

allusion to represent Christian ideas (as, Jove for Jehovah, etc.), or to shut out Christian ideas (as in the love poet's use of a classical atmosphere for a "moral holiday"). The issue is particularly interesting when there is a mixture of Christian and classical material, or when there is some attempt to balance or reconcile the traditions.

Of larger significance is the problem of the Christian poet who attempts to make a religious statement in classical literary modes. Here the tension is generated partly by the Christian attitude toward literary artifice, which is deemed unnecessary, untrue, and unworthy of the true believer. A more fundamental incompatibility between literary form and religious matter may be seen to follow from the mystical and abstract nature of Christian truths, which resist concrete embodiment in poetry. Resolution of this conflict is seen as Milton's primary artistic problem in *Paradise Lost*; the consequences of the conflict in the poem are reviewed in detail.

Though the emphasis naturally varies in the examination of each poet, some attempt is made in the conclusion to evaluate the part played by this tension in the poetry as a whole. The particular complexity and depth fostered by the tension in both the love lyric and the religious lyric is related to the dominant characteristics of the poetry of the period and to the special excellence attributed to this poetry in modern times. 191 pages. \$2.50. Mic 57-2501

W. B. YEATS AS LITERARY CRITIC

(Publication No. 21,654)

Sidney Warschausky, Ph.D.
Columbia University, 1957

Yeats's profound development as a poet is better known than his attempts to illuminate this development in his formal and occasional prose. Though the poetry will always remain primary, the prose is of great importance, not only because it helps us to read the poems, but also because it comes to serve as an acute critical instrument. Between 1886 and 1939 Yeats again and again used his essays, reviews, diaries, and letters as media for defending his own work and the class of literature to which he thought it belonged. Such a defense impelled him to distinguish between this class and (chiefly) the body of nineteenth and twentieth century literature that he believed to be founded on false literary and metaphysical principles. Though Yeats never abated his attacks on narrowly realistic and didactic literature, the nature of the attacks inevitably altered as his own aesthetic views underwent a radical transformation.

Like his poetry of the period, the prose that Yeats publishes before 1902 moves within the romantic orbit. The first chapter of the thesis briefly sets the stage by presenting pertinent literary characteristics and principles of Blake, Wordsworth, Coleridge, Shelley and Keats, and makes clear, not only why Yeats believed Blake and Shelley to be the prophets of his own school, but also in what ways his understanding of each of the early romantics was limited. Since Yeats at first saw these writers in terms of the critical conflicts that were being waged at the end of the nineteenth century, the second chapter is given over to his conflict with "the Matthew Arnold tradition" and to his

criticism of a quite similar tradition then dominating Irish criticism, most seriously represented by the writings of Edward Dowden and John Eglinton.

Yeats derived his early "anti-utilitarian" symbolist principles from the theosophists and their predecessors. The third chapter contains an examination of the manner in which, with limited success, he tried to dovetail theosophy and the aestheticism that he inherited most notably from Arthur Henry Hallam, the early Pater, and Rossetti and Morris. The impact of his aesthetic principles on his views of Blake and Shakespeare is analyzed in detail. The French only reinforced Yeats's movement away from explicit theosophical symbolism toward the suggestive image valued by the aesthetes. In the fourth chapter, the way in which Yeats's work is related to French symbolism is studied, as well as his final attempt before 1902 to re-establish the place of traditional or occult symbols in poetry. How this somewhat new idea of the function of such symbols affects Yeats's view of Shelley's work is shown at the end of the chapter.

Despite its fragmentary and heterogeneous nature, the prose that Yeats writes after 1902 is far more valuable than his earlier work. Chapter V reveals how his critical work as father of the Irish dramatic movement entails a radical reaction against his own earlier poetry and aesthetic principles. In this and the following chapter his evolution of a theory of tragedy is presented in detail, and its limitations noted. The fifth chapter also includes a section on Yeats's critical support of Synge. In 1909, when Yeats became estranged from the Irish theatre public, he was about to return to the lyrical mode. How he transferred his tragic principles to this mode, provided them with a new metaphysical foundation, and went on to criticize contemporary poetry as a result, is traced in the fifth chapter. The thesis ends with a brief attempt to establish Yeats's value and limits as a literary critic.

324 pages. \$4.15. Mic 57-2502

**THE FIRST TWO EDITIONS OF COLERIDGE'S
FRIEND: EDITED BY LUCYLE WERKMEISTER**

(Publication No. 17,368)

Lucyle Werkmeister, Ph.D.
The University of Nebraska, 1956

Adviser: Professor Thomas M. Raysor

This dissertation is an edition of the 1809-1810 and 1812 Friend with introduction and editorial notes. The text is that of 1809-1810, collations being made with the version of 1812. The chief purpose of the editor has been to make the text intelligible. Arguments are therefore furnished for the more philosophical essays, and all essays are copiously annotated. The notes include identification of quotations, references to parallel or illuminating passages in other works by Coleridge, evident sources of material, relevant historical and biographical data, and suggested solutions of those linguistic and material riddles

which tend to obscure the reader's understanding of the text.

The first section of the introduction considers some broad sources of Coleridge's philosophy. The early Coleridge is placed in the school of Helvétius, not Rousseau. Berkeley's influence is presented as crucial, jarring Coleridge from his early necessitarian optimism and furnishing the basis for the idealistic philosophy expressed and implied in the Friend. From Berkeley, it is maintained, Coleridge derived his unorthodox interpretation of Plato's philosophy, his notion of sin as a perversion of the understanding, his belief in the reality of ideas and in the immediacy of man's awareness of truth, his conception of evil as punishment for the transgression of law, and his interpretation of nature as the language of God. Kant is shown to have modified Coleridge's thinking in only one important respect: he convinced Coleridge that the "ideas" of the reason were not subject to logical demonstration. Fichte's influence is assigned chiefly to the field of ethics. From Fichte Coleridge derived the notion of "consciousness" as the end of human existence and perhaps also, through a modification, the conception of individual life as proceeding from a state of innocence through a state of sin to a state of virtue.

The second section considers Coleridge's thinking with respect to man and the cosmos. It is maintained that the problem of human salvation is central to all Coleridge's thought and that his primary concern is to assist man, necessarily fallen from a state of innocence into a state of sin, in his struggle toward virtue and hence eternal bliss. This section therefore attempts, first, to understand the central problem by attempting to ascertain precisely what Coleridge means by "original innocence," "original sin," "freedom" and "the will," "conscience," "reason," "understanding," and "nature." "Virtue" is then shown to be equatable with "faith," the object of which is "reason," and the ultimate end of all the sciences, arts, and humanities is shown to be the furthering of such "faith." The section concludes with an examination of the methodology and particular function of the sciences, history, philosophy, religion, and poetry.

The third section attempts to present Coleridge's political thinking in its religio-philosophical context. Beginning with his assertion that the purpose of the state is to "humanize" the "animal man," thus enabling him to accept the means of salvation, this section considers how such "humanizing" is effected and what kind of state can best effect it. The similarity between Coleridge's political principles and those of Berkeley is throughout noted. It is concluded that Coleridge brought Augustinian thought to its highest level of completeness, systematization, and richness.

The final section details the history of the Friend. The wisdom and integrity of Daniel Stuart's "management" are here called into question. The usual assumption that the Friend was a financial failure is also challenged. As editor of the Friend, Coleridge is exonerated from charges of indolence and irresponsibility: he emerges as a man of heroic action and steady moral purpose, defeated at last by exhaustion and despair.

1458 pages. \$18.35. Mic 57-2503

LIBRARY SCIENCE

THE PRINTING, PUBLISHING, AND BOOKSELLING ACTIVITIES OF JOHN P. SHELDON AND HIS ASSOCIATES IN DETROIT, 1817-1830: A STUDY OF THE DETROIT GAZETTE, THE OFFICIAL AND GENERAL PUBLISHING OF THE GAZETTE PRESS, AND THE DETROIT BOOK STORE

(Publication No. 21,150)

Wallace John Bonk, Ph.D.
University of Michigan, 1956

This study is concerned with the Detroit Gazette, established in 1817 by John P. Sheldon and Ebenezer Reed, with the non-newspaper publishing of the Gazette press, and with the Detroit Book Store, which Sheldon and Reed established when they founded the Gazette.

The first issue of the Gazette appeared July 25, 1817, and the last May 26, 1830. It was destroyed in a fire set by Ulysses G. Smith, a journeyman printer for the Gazette. The paper was never a profitable venture: income from job and official printing enabled Sheldon to support it. Sheldon and Reed believed that a newspaper ought to be a free organ for expressing public opinion, that it was an editor's duty to ferret out official misconduct, and that they ought to encourage the literary talent of Michigan. The paper also assumed an official function in its publishing of the Territorial and United States laws.

The Gazette began its career as a non-partisan paper. The editors, however, became personally involved in political affairs, and, after 1825, they devoted their efforts to attacks upon the Whig officials of the Territorial government. Reed's criticism of Charles Larned, Territorial Attorney General, led Larned to sue for libel, and Reed was adjudged guilty by default for failure to file a proper plea. Sheldon was fined and imprisoned by the Territorial Supreme Court because of an editorial critical of one of its decisions. The court's action was considered tyrannical, Sheldon became a hero in Detroit, and his case was the subject of sympathetic editorials in newspapers throughout the country.

In addition to publishing the Gazette, the press also printed official Territorial publications, and these constituted over one-third of the total number of items published. A better picture of the actual bulk of the official printing is given if one uses the total number of pages printed as a basis for calculation. According to this method, over eighty-six per cent was Territorial material. The Territorial printing included the laws and bills of the Councils, the journals of the sessions, and a number of lesser items -- the Governor's speeches, memorials to Congress, and bills intended for public distribution.

There are forty-four non-official items extant, consisting of twenty pamphlets, twenty-three broadsides, and one map. One newspaper was printed briefly in addition to the Detroit Gazette; it was the Gazette Française, no copies of which have survived. Interest in this material must devolve largely from the fact that it represents the

period of early Michigan printing and from occasional association values, rather than from any intrinsic merit of the individual publications themselves. A list of both the official and general publications of the press is appended to the thesis.

Five hundred and ninety-three titles were advertised for sale in the Detroit Book Store in the period 1817-1828. The most striking fact about the collection is the predominance of literature: fifty-one per cent of the titles fall into that category. The books which were advertised in all categories were largely very popular and successful ones, many having long records of successive editions. Most of the titles were published in American editions, many were intended for school use, and the stock shows many correlations with the ideas and activities current in Detroit at that time. It seems reasonable to conclude that the list of books for sale which is appended to the thesis furnishes an excellent picture of the contents of the average bookstore in the small but aspiring community at some distance from the metropolitan centers.

241 pages. \$3.15. Mic 57-2504

CHARACTERISTICS OF LIBRARIES IN SELECTED HIGHER MILITARY EDUCATIONAL INSTITUTIONS IN THE UNITED STATES

(Publication No. 20,867)

Robert Kellogg Johnson, Ph.D.
University of Illinois, 1957

Since the occupation of the garrison site of West Point in 1779, many schools have been established by the United States armed services. A large part of this dissertation is based upon a detailed investigation by the present writer of the operations and services of a group of 18 of these schools. The completed project resulted in a set of reports covering the activities of 15 libraries serving 16 schools of the three major services, and the three libraries serving the joint military schools.

The materials for these basic studies was gathered firsthand on trips by the writer to the institutions and the libraries. Inasmuch as the Air University Library requested permission from these institutions to make the studies rather than being asked to conduct them, the basic reports are not administrative or critical evaluations, but consist largely of objective comment based upon manuscript and published information about the institutions and their libraries, questionnaires covering education and experience of the librarians, and observations by the writer concerning the operations and services of these libraries. A preliminary edition of each report was made up for revision by the institution and library covered, so that in final form they were correct, and acceptable to the institution. A retention copy of the revised report was

prepared for each institution upon receipt of the revision.

The material presented in the dissertation follows more or less the same order as that used in the basic studies. Matters described include origin, mission, and organization of each institution, its curriculum, faculty, student body, and data pertinent to the libraries' organization, operations and services, obtained from library, institutional, and other publications and sources, and from conferences with staff members of the institutions and libraries. Discussed here are origin and mission of the libraries, organization, personnel, equipment and supply problems, budget and other administrative matters, resources, acquisitions, cataloging, indexing, circulation, reference and bibliography, etc.

The findings concerning the libraries are important. In most of these schools the library is assigned to a relatively low level within the institution, often being equated with supply, admission, "housekeeping" and clerical activities. Among important problems facing most of these libraries are: insufficient staff, too greatly circumscribed staff professional activities, inadequate and undependable funding, seriously deficient quarters and facilities, major procurement difficulties, overly elaborate accountability controls, the problems of obtaining well-qualified librarians, and the general unsatisfactoriness of military personnel in "civilian" type library billets.

The libraries collect materials in most of the forms in which knowledge is available in print, near-print, and non-print media. Only a few of the libraries have basic general collections in addition to their core of highly specialized resources. The collections range from about 5,000 to well over 300,000 bound volumes, and from approximately 5,000 to over 527,000 documents. Their holdings approach 1,300,000 bound volumes and total over 1,000,000 documents. Their fields of greatest concentration of resources are history, military art and science, social sciences, science and technology, and air power.

It is significant that administration and acquisitions, the areas where these libraries are most restricted by military interference, and government and military laws and regulations, are the areas from which most of the serious current problems in these libraries arise. Conversely, cataloging, circulation and reference, the functions which are least subject to such regulatory superimposition, have fewer serious problems of government or military origin. To date most of the important experiments and developments in military academic librarianship have occurred in cataloging and reference. The most significant of these have come out of the libraries under civilian administration rather than those under military administrators or "library officers."

373 pages. \$4.80. Mic 57-2505

MATHEMATICS

A PROBABILITY MODEL FOR THEORY OF ORGANIZATION OF GROUPS WITH MULTI-VALUED RELATIONS BETWEEN PERSONS

(Publication No. 21,046)

John Lucian Bagg, Ph.D.
Michigan State University, 1956

This thesis is concerned with a probability model for group organization theory permitting multi-valued relations between persons. The most difficult problem in connection with this model was the development of a method of enumerating the elements in the universe of discourse.

The introduction briefly discusses the development of the matrix model presently being used in connection with sociometric tests. In addition the evolution of the extension to multi-valued relations is examined and a comparison is made between the difficulties surmounted in this study and those in the previous original study for the binary case.

The beginning portion of the next section sets up the machinery to be used in the three stage development leading to the main theorem. Due to the complexity of the problem it was considered important to indicate the evolution of the process which led to the general result.

The results of the first two stages are special cases of the main theorem. The main theorem provides a method for enumerating the total number of ways in which n persons can classify each of the other $(n-1)$ persons into one

and only one of $(k+1)$ categories, with no restrictions on the number in any given category. This number is given in two ways, first as an expression involving untabulated hollow bipartitional functions, and second in terms of regular bipartitional functions tabulated by David and Kendall.¹

This theorem makes possible the formulation of exact probability distributions for a large class of random variables. The last part of the thesis indicates a procedure for defining such random variables on a subspace of the sample space of all outcomes. Given a sociometric test, the nature of the test determines the universe of discourse for these random variables. Once this is decided, the definition of the random variable is a matter of expediency. For a large class of sociometric tests, e.g., those satisfying restrictions given previously, the exact distribution of these random variables can be found by methods developed in this paper.

80 pages. \$2.00. Mic 57-2506

1. See reference [1].

**NON-COMMUTATIVE FINITE GROUPS WITH
NO IRREDUCIBLE REPRESENTATIONS OF
DIMENSION HIGHER THAN TWO**

(Publication No. 21,282)

Jack Edwin Forbes, Ph.D.
Purdue University, 1957

Major Professor: Ralph Hull

The class of non-abelian finite groups with no irreducible representations of dimension higher than two is studied to test the conjecture that the class coincides with those non-abelian groups which contain an abelian subgroup of index two. First, the groups are explicitly determined which have two-dimensional isomorphic representations by matrix groups whose matrices are of determinant unity and which have no irreducible representations of higher dimension. Next, the groups with isomorphic irreducible two-dimensional representations and no irreducible representations of higher dimension are explicitly constructed as extensions of groups of the first class. Lastly, some results concerning the general class of non-abelian finite groups with no irreducible representations of dimension higher than two are obtained, using the properties of the groups of the first two classes. The principal result is that a non-abelian group is of the class under consideration if it has an abelian subgroup of index two. Then, an example is given which shows that this sufficient condition is not necessary, and that, therefore the above mentioned conjecture is false. 56 pages. \$2.00. Mic 57-2507

**TEACHERS OF MATHEMATICS IN
LIBERAL ARTS COLLEGES OF
THE UNITED STATES, 1888-1941**

(Publication No. 21,635)

Lester Lipman Gavurin, Ph.D.
Columbia University, 1957

Chairman: Howard F. Fehr

The first person to hold the title of Professor of Mathematics was appointed in 1711 at the College of William and Mary, and from that time until the present, a great many men have taught mathematics at liberal arts colleges in the United States. While the content of the mathematics program at such schools has come under close scrutiny, and many special problems in connection with the teaching of college mathematics have been considered, the people who have been in charge of carrying on this instruction have remained almost unobserved as a group. It was the object of this study to develop a clear and accurate picture of the teacher of mathematics at liberal arts colleges in the United States during the years 1888-1941, since such a picture is of prime importance in understanding the kind of mathematical training which has been offered at these schools; since it can provide a useful background for those who will in the future select the teachers of mathematics at such institutions; and since it has an inherent interest of its own.

Although the study was limited to the years between

1888 and 1941, the developments during the peripheral periods were also considered in a general way. The individual whose careers were studied taught either at one of the twenty-five oldest colleges in the United States, or at one of 117 sample colleges which were selected on the basis of size, age, administrative control, and geographic location. The careers of these individuals were followed, with particular emphasis on their training and professional work, in college catalogues and other college publications, and then in various biographical dictionaries, journals of professional and educational societies, and such related literature. In the process of organizing, analyzing, and interpreting the data, the picture of the teacher of mathematics at liberal arts colleges in the United States was unfolded.

The problem was approached in two different ways, first, a chronological development for those who taught at the twenty-five oldest colleges. The changes in the mathematics teacher at these institutions were observed through the years from 1888 to 1941, as he developed from an individual trained in the classical tradition (and very often only incidentally associated with the field of mathematics), into a highly trained specialist in a very highly developed field. Such things as the growing importance of advanced training, accomplishments in research, and previous teaching experience, for instance, all formed part of the changing picture. The tremendous increase in college enrollments, the growth of colleges into universities, the establishment of important graduate schools of mathematics, and the effects of war and depression, were all observed as important factors which produced changes in this individual.

The second approach was in relation to those who taught at the 117 sample colleges. An analysis of the data obtained for these faculty members revealed that of the four criteria used in setting up the sample, the criterion of size was the most significant of all. Closely related to the size criterion was that of administrative control. The sample denominational colleges were mostly found to be small schools, while the publicly administered colleges were more often large institutions.

The careers of those who taught at schools representing the different size categories were compared to those of the teachers at the twenty-five oldest colleges. From this comparison it was found that the various stages of development which the faculties of mathematics exhibited at colleges representing the different size categories were the same stages which took place in the teacher of mathematics at the twenty-five oldest colleges over the years 1888-1941. An obvious relationship could be seen between the size of a school; the existence of a graduate department of mathematics; and the type of individual on the faculty. The differences between the individuals who taught at the twenty-five oldest colleges at the beginning and end of the 1888-1941 time interval were almost the same differences observed in the individuals who taught at institutions representing the opposite extremes of the size scale of the 117 sample colleges. 298 pages. \$3.85. Mic 57-2508

INTRACLASS RANK CORRELATION AND ITS USES IN RESEARCH INVESTIGATIONS

(Publication No. 21,700)

Gerald J. Glasser, Ph.D.
New York University, 1957

Chairman: Professor John J. Kinsella

This study formulates a general coefficient of intraclass rank correlation and surveys its potential uses in research investigations. This statistical technique is developed primarily as a test of significance for independence between categorized data or sub-groups. Its uses as a descriptive measure are also considered.

The statistic for a test of significance is the coefficient of intraclass rank correlation, which is based on the variate definition of ranks. That is, it is patterned after the classical variate approach in intraclass correlation analysis. However, in this rank coefficient, ranks replace ordinary variables.

A special formula is studied for paired data. It is analogous to the well-known rank difference formula due to Spearman, but while the former is useful for univariate data, the latter is applicable only to bivariate data. This coefficient of rank correlation for pairs, \underline{l}_r , is discussed theoretically and its use is illustrated with various research problems. This statistic is defined by the following formula:

$$\underline{l}_r = 1 - \frac{12 \sum d^2}{n(n^2 - 1)}$$

\underline{l}_r : the coefficient of intraclass rank correlation for paired data,

n: sample size,

$\sum d^2$: the sum of squared differences between the ranks of paired items.

Its exact sampling distribution under the null hypothesis is given for $n = 4$ (2) 10 and approximations for $n > 10$ are considered.

The more general coefficient, L_r , is applicable even when larger samples than two per sub-group (paired data) are to be analyzed. This statistic is also considered theoretically and illustrated by applications to specific problems. This measure is defined as follows:

$$L_r = \frac{1}{\bar{r}-1} \left\{ \frac{12 \bar{r} S_b^2}{n^2 - 1} - 1 \right\}$$

L_r : the coefficient of intraclass rank correlation,

\bar{r} : average sample size per sub-group,

n: total sample size,

S_b^2 : rank variance between sub-groups.

The relationships between \underline{l}_r , L_r and other nonparametric statistics, including the Kruskal-Wallis H-test, are discussed. Other problems in connection with these measures are considered. 129 pages. \$2.00. Mic 57-2509

ON THE GENERALIZED RADIATION PROBLEM OF A. WEINSTEIN

(Publication No. 21,529)

H. Melvin Lieberstein, Ph.D.
University of Maryland, 1957

Supervisor: Professor A. Weinstein

Solutions $u^{[k]}$ for all $-\infty < k < 1$ of the two-dimensional Euler-Poisson-Darboux equation

$$u_{xx}^{[k]} = u_{yy}^{[k]} + \frac{k}{y} u_y^{[k]}$$

are constructed such that

$$u^{[k]}(x,0) = f(x), \quad u^{[k]}(x,x) = g(x)$$

where f and g are given functions with a specified number of continuous derivatives on the closed interval $[0,a]$, $a > 0$, and another specified number of vanishing derivatives at the origin, both numbers depending on k. This construction is accomplished for solutions that have at least two continuous derivatives on the characteristic line $y = x$, and uniqueness is established for this type of solution without assuming the existence of any outer derivatives on the singular line $y = 0$. Solutions for the case $g(x) = 0$ were obtained earlier by A. Weinstein, and in this case the new solutions require roughly half as many continuous derivatives for f when k is large. Two important properties of the Weinstein solutions are lost, however, for we do not obtain any solutions which possess only one derivative on $y = x$ (uniqueness for this case is still unsettled), and further, we can no longer present one formula for all k.

Of principal interest here are the Weinstein recursion principles and a recursion formula due to L. Payne. The first is used to obtain uniqueness for all $k < 0$ from uniqueness for $-2 < k < 0$ by way of induction, the second to construct solutions for all $k < 0$ from solutions for $-2 < k < 0$. The general solutions obtained by Darboux and E. K. Blum play a basic role throughout.

A generalized Huygens' principle is noted with respect to the data g(x) for $k = 0$ only. Our mathematical problem is related for this value of k to radiation phenomena in a space of three dimensions or a space-time of four dimensions so that a characterization of a space-time of four dimensions is provided. It is further shown that polynomial data g(x) yield polynomial solutions only if k is an even negative integer, though polynomial solutions do exist if k is any real number, $k < 1$.

The problem with data on a non-singular line is briefly investigated and it is shown that restrictions on the data are much less severe for this case - these restrictions do not even depend on the parameter k. Finally, consideration of the non-singular problem for $k > 1$ in a certain limiting sense yields evidence of the non-existence of solutions to the singular problem for $k > 1$.

98 pages. \$2.00. Mic 57-2510

THE UNSYMMETRICALLY FED PROLATE SPHEROIDAL ANTENNA

(Publication No. 21,071)

Hugo Alexander Myers, Ph.D.
Michigan State University, 1954

The problem studied in this thesis is the unsymmetrically-fed prolate spheroidal transmitting antenna. The prolate spheroidal functions are expressed in the form of power series and Laurent series. Radiation patterns have been obtained for antennas of three different lengths up to about one wave length long, for length/thickness ratios of about 5/1, 10/1, 22/1, and 316/1, and for nine unsymmetrical gap locations as well as for the symmetrically-fed cases. Two methods have been developed for computing antenna impedances that take into consideration the width of the gap and the geometry of the transmission line feeding the antenna. One method is based on the usual assumption that the current is driven by the field in the gap. The other method is based on the assumption that the current in the antenna elements is driven by the component of the electric field of the transmission line that is tangential to the elements. Further refinements in the impedance theory will probably have to depend upon experimental evidence.

107 pages. \$2.00. Mic 57-2511

MODULAR REPRESENTATIONS OF THE SYMMETRIC GROUP

(Publication No. 21,389)

Orrin Edison Taulbee, Ph.D.
Michigan State University, 1957

Much of the general theory of matrix representations of a finite group was developed by Frobenius, Burnside and Schur around the turn of the century and shortly after. Alfred Young, a clergyman by profession, devoted the years 1901-1934 to a development of the representation theory of the symmetric group S_n . These representations by matrices over a field of characteristic zero are called ordinary representations.

The earliest account of any theory of representations of a finite group over a field of prime characteristic p is that of Dickson in 1907. This theory, the modular representation theory, lay dormant for thirty years until Brauer and Nesbitt published a monumental work along these lines. Robinson, who took up the study of the symmetric group where Young left off, Nakayama and others turned their attention to the modular representations of the symmetric group.

A representation over a field of characteristic zero is completely reducible but this is no longer the case if this representation is considered over a field of characteristic p , where p divides the group order, so that indecomposable representations are obtained as well as modular irreducible representations. The determination of both these types of representations provides a very difficult problem for they are defined in terms of matrices which are impractical to obtain for a general finite group. For example, two necessary conditions are known in order that a representation be an indecomposable representation. However, no

sufficient conditions are known. Even less is known about the modular irreducible representations.

A considerable amount of work has been published on the indecomposable and modular irreducible representations of the symmetric group. The Young diagram was essential in all this development. But still no sufficient conditions are known for an indecomposable except in a few very special cases. In Part V the indecomposables and the corresponding modular irreducible representations of S_n are obtained for any prime p . Briefly, the D-matrix for S_n is found and consequently all the information arising therefrom is obtained.

As a starting point in the determination of the D-matrix of S_n two basic ideas are used. One is the fundamental theorem of Robinson which states that there are exactly as many p -regular diagrams, called heads, in block B as there are indecomposables in B; the second is Littlewood's concept of the admitted permutations of an indecomposable. First it is shown that each head admits at least one permutation not admitted by a higher head if the heads are arranged in dictionary order. Then the set B_j of such permutations admitted by H_j are used to construct a set of M_j of diagrams by Littlewood's rule of construction. The fundamental tool in the proof that the set M_j of representations constitutes a single indecomposable are the Nakayama reciprocity formulas. Naturally, the proof is inductive. The total number a_j of permutations admitted by every diagram belonging to M_j yields the degree of the modular irreducible representation corresponding to the indecomposable formed by M_j . An important result is that the indecomposables of S_n can be obtained without any knowledge of the indecomposables of S_m , $m < n$.

In Part VI an alternative approach to the determination of the D-matrix of S_n is considered. There a raising operator Y_p , which is the familiar Young operator required to satisfy three additional conditions, is defined which operates on certain specified diagrams, called feet, to give the ordinary irreducible representations belonging to an indecomposable. The foot diagrams belonging to a block B are the diagrams conjugate to the heads of the conjugate block B' . The proof that the operator Y_p does give the indecomposables of S_n is deduced from the first method considered. An important consequence of this latter approach is that the ordinary representation theory is a special, limiting case of the modular representation theory.

144 pages. \$2.00. Mic 57-2512

AN EVALUATION OF SELECTED TEACHING AIDS FOR PLANE GEOMETRY

(Publication No. 21,413)

Billy Lawrence Turney, Ed.D.
University of Houston, 1957

Purpose of this study. The purpose of this study was (1) to make a survey of teaching aids being used in the teaching of plane geometry; (2) to describe these aids according to their construction and application; and (3) to evaluate these aids as effective and practical means of instruction. The last of the three objectives was of primary importance in the study.

Importance of the study. The understanding of concepts of plane geometry has long been a source of difficulty for many high school students. Teachers have developed aids to make these concepts more understandable to the student, yet very few attempts have been made to make these aids available to other teachers of plane geometry. At present there is no publication in existence that serves both as a descriptive and as an evaluative source of teaching aids for plane geometry.

Procedures and sources of data. One hundred twenty-one teaching aids were selected from aids obtained from questionnaires, literature, and personal interviews. Criteria for evaluation were developed to rate each of these aids individually. The evaluation was performed by a jury of experts consisting of Frances Burns, Lurnice Begnaud, Ida May Bernhard, John Schacht, Donavan Johnson, Emil Berger, Lauren Woodby, and Henry Syer. The aids were rated as (1) learning aids, (2) instructional aids, and (3) practical aids. An illustration and description were prepared for each aid, and these were accompanied by the evaluative data.

Conclusions. The conclusions of this study were as follows:

1. The use of teaching aids in plane geometry is not widespread.
2. Several major reasons were found for the non-use of plane geometry teaching aids: (a) lack of adequate storage facilities, (b) lack of adequate time for construction, (c) lack of money, (d) inconvenience of usage, and (e) lack of a convenient source of such aids.
3. Both commercial and non-commercial aids have their place in the instruction of plane geometry.
4. Plane geometry teaching aids should not be constructed for the sake of the aid.
5. Many plane geometry teaching aids have multiple uses.
6. Two extensive published sources of non-commercial teaching aids are now available to teachers of plane geometry: (a) The Mathematics Teacher and (b) The Eighteenth Yearbook of the National Council of Teachers of Mathematics.
7. The criteria for evaluation of plane geometry teaching aids can be classified in three general areas: (a) learning, (b) instructional, and (c) practical.

Recommendations. The following recommendations were offered:

1. Teachers of plane geometry should use teaching aids to supplement the written word of the textbook.
2. Teachers of plane geometry should avail themselves of several well-chosen aids.
3. Teachers should strive to develop the ability to

view various materials and objects as potential teaching aids.

4. Teachers of plane geometry should insist on well-constructed teaching aids.

5. All plane geometry teaching aids of a non-commercial nature should be evaluated as learning aids, as instructional aids, and as practical aids.

6. Teachers of plane geometry should use the individual evaluation data in this study as a discriminatory guide for the selection of teaching aids.

7. Steps should be taken to make this study available to teachers of plane geometry.

8. A future study should be conducted for the purpose of evaluating commercial teaching aids for plane geometry. 313 pages. \$4.05. Mic 57-2513

COMBINING INDEPENDENT TESTS OF SIGNIFICANCE FOR INCOMPLETE BLOCK DESIGNS

(Publication No. 21,407)

Marvin Zelen, Ph.D.
The American University, 1957

Consider an incomplete block design where the number of blocks is greater than the number of treatments ($b > v$). It is then shown under the usual assumption for the recovery of inter-block information that two independent variance-ratio tests exist for testing any general linear hypothesis pertaining to the treatment effects. Let F_i ($i = 1, 2$) denote the variance ratio for each test, and let δ_i be the associated non-central parameter such that $\delta_i = 0$ if the null hypothesis (H_0) is true; also define $P_i = P\{F \geq F_i | H_0\}$. Then a proposed test for rejecting H_0 is to reject H_0 at the α significance level if $\{P_1 P_2^\Theta \leq C_\alpha\}$. Here Θ ($0 \leq \Theta \leq 1$) is a weighting function which weights the second test relative to the first and C_α is a constant depending on the level of significance. If Θ is selected such that $\Theta = \delta_1/\delta_2$, the type II error appears to be a minimum. For incomplete block designs, the weighting function is $\Theta = \frac{1-E}{E} \frac{\sigma^2}{\sigma^2 + k\sigma_b^2}$, where E is the efficiency of the intra-block analysis, σ^2 and σ_b^2 are the "within" and "between blocks" variance components respectively, and k is the plot size. Approximations to the power functions are given as well as tables of the type I and type II error. The calculations show that the proposed critical region for combining the two tests is more powerful than the well-established method of R. A. Fisher which is equivalent to always choosing $\Theta = 1$. 71 pages. \$2.00. Mic 57-2514

MUSIC

THE RELATION OF MOOD AND MELODIC PATTERN IN FOLK SONGS

(Publication No. 21,688)

Leo Horacek, Ph.D.
University of Kansas, 1955

This study was concerned, not with performance characteristics, such as tempo and volume, but only with characteristics which remain similar in all performances, such as modality, melodic pattern and rhythmic structure, and which serve to determine the identity of a particular folk song.

The study had three aims:

1. To establish whether specific characteristics of melodic pattern are related to specific mood.
2. To discover some of the characteristics related to certain moods.
3. To determine whether or not these relationships of specific characteristics to mood are the same or different in different cultures.

The musical material consisted of folk songs of four cultures - German, French, English, and Southern Appalachian - approximately 100 of each. The words of each song were submitted, separate from the musical score, to judges, three for each culture, who judged the mood of each song and recorded it on two mood scales of ten steps each, one ranging from "gay" to "sad," and the other from "energetic" to "quiet." Approximately the extreme third of the songs of each end of each mood scale were used for musical analysis and comparison.

The musical analysis consisted primarily of determining the incidence of a number of musical characteristics, most of which are quite quantitative.

Four methods of detection of modal differences were used. The first was based only on the final tone; the second, on whether the third of the key was major or minor; the third, on the percentage of phrases ending on each scale tone; and the fourth, on the functional importance of each scale tone, determined by frequency and importance of position.

Melodic characteristics considered were: size of intervals, direction of final cadence, direction of phrase endings, and pitch range.

Rhythmic characteristics considered were: basic rhythmic pattern, number of direction changes of melody, number of changes of tonality, numbers of beats and notes.

Where appropriate, data were changed into percentages and averaged or totaled to arrive at a figure representative of the group of songs of a certain mood.

Results and Conclusions

Conclusions related to the first aim of the study were based upon 163 significance tests (Chi square) which were made on various data from opposing mood groups.

Twenty-five of these tests resulted in a p of .001 or better, forty in a p of .01 or better, and sixty-six in a p of

.05 or better. It was concluded that melodic pattern is functional in the determining of mood expressed in the songs.

Results related to the second aim, that of discovering some of the specific relationships of musical pattern to mood, were numerous. Only those common to all cultures involved in the study were considered. The most important are: the scale tone Do tends to be associated with gay songs, Re and La with sad; the third of the scale is more frequently major in gay than in sad songs; Do is more frequently and La less frequently found on phrase endings in gay than in sad songs; more melodic unisons and fewer seconds and thirds are found in gay than in sad songs.

The third aim, that of discovering intercultural differences in the relation of mood to melodic pattern was satisfied by abundant data. Most notable are a distinct mood function of mode found in the German songs, but not in those of the other cultures; and an apparent relationship in French and Appalachian songs of triple rhythm to sad mood, and in German to gay.

141 pages. \$2.00. Mic 57-2515

THE CANTATAS OF JOHANN LUDWIG BACH

(Publication No. 21,557)

Angela Maria Jaffé, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Karl Geiringer

The purpose of the investigation of Johann Ludwig Bach's seventeen liturgical cantatas and the "Trauermusik" was to establish their position within the historic development of the German sacred cantata between the seventeenth and eighteenth centuries, to study their stylistic and formal characteristics, and to present an objective picture of the work of this generally unknown cousin of Johann Sebastian Bach.

The study of these works was made from microfilms of the original manuscripts now in the libraries of Berlin and Marburg. Texts and chorale melodies were traced through examination of the Bible, collections of sacred poetry, hymnals, and chorale melody collections. Works of a similar character by earlier, contemporary, and later composers were analytically examined for comparison and to help place Johann Ludwig's compositions in the overall historic development of the cantata form. Historical and documentary data were obtained from numerous literary sources dating from the early eighteenth century to the present.

The seventeen liturgical cantatas and the "Trauermusik," by Johann Ludwig Bach (1677-1731), represent the height of the development of the Reform cantata. This particular form grew out of the older chorale cantata by admitting the da capo aria and the secco and accompagnato recitatives.

from the operatic medium and substituting pure or paraphrased Bible verses and free composed texts for the chorale. This new practice gave the composers the freedom of an interpretative setting.

The manuscripts of the liturgical cantatas are in the handwriting of Johann Sebastian and are undated. The "Trauermusik" is in an unidentified handwriting and is dated 1724. The former are scored for four-part mixed chorus, string orchestra, and continuo, with an occasional addition of concertizing oboes or horns. The latter is scored for two four-part mixed choruses and two orchestras, the first consisting of strings only, the second alternating between strings, flutes, and oboes; flutes and oboes; and clarini, flutes, oboes, and tympano. The keyboard instruments are organ for the liturgical cantatas, harpsichord for the "Trauermusik."

The liturgical cantatas were intended for fixed and movable Lutheran feast days. They are frequently divided into two parts (the first to be presented before and the second after the sermon) with the sermon acting as mediator between the settings of contrasting texts.

The "Trauermusik" was written for the funeral service of Duke Ernst Ludwig of Saxe-Meiningen, Johann Ludwig's patron. Besides verses 16-19 of Psalm 116, a poem by the

Duke was used as text. A melody written by the Duke served as the source of thematic materials.

The characteristics of Johann Ludwig's music are: melodic sequences on text repetitions; sectionalization and change of metre according to textual divisions; melismatic interruptions of straight vocal solo lines; homophonic tutti chords separated by rests introducing fugal numbers; thematic interchange between instruments and voices; entrance imitation between voice and continuo in recitatives; triadic vocal progressions in recitatives; chromaticism, Neopolitan Sixths, and augmented and diminished interval leaps in settings of passages dealing with death, tears, sin, and pain; melismatic settings of passages pertaining to joy, praise, life, and heaven; stepwise progressions denoting movement; ascending and descending lines indicating direction; predominance of da capo form in arias; alternation of recitatives and arias; a final polyphonic chorus followed by a homophonic chorale; and absence of true instrumental introductions.

The cantatas of Johann Ludwig Bach fuse into an organic whole all the elements of the Reform cantata and represent the last stage of this particular formal development, to which Johann Sebastian added the final chapter.

568 pages. \$7.20. Mic 57-2516

PHARMACOLOGY

THE PHARMACOLOGY AND TOXICOLOGY OF EXTRACTS, EXTRACTIVES AND CRYSTALLINE SUBSTANCES OBTAINED FROM Hippomane mancinella L.

(Publication No. 20,092)

Marcus Newman Carroll, Jr., Ph.D.
The University of Florida, 1952

Review of the literature and personal communications with people residing in areas where the manchineel tree grows reveal that humans are poisoned by Hippomane mancinella L. after ingestion of the fruits or exposure to the sap or pollen.

Aqueous, saline and alcoholic extracts from Hippomane mancinella L. were screened for their pharmacological actions.

The crystalline substance 2-hydroxy-4,6-dimethoxyacetophenone, isolated from Hippomane mancinella L., was found free from toxicity and pharmacologically inert.

The pharmacological actions produced by the extracts suggest that the toxic constituent(s) present may be saponins (sapotoxins; sapoglycosides).

Toxicological studies reveal that the extracts produce transitory damage in the kidney and liver after the injection of sublethal doses into animals.

91 pages. \$2.00. Mic 57-2517

A CORRELATION OF PHYSICAL ASPECTS IN TABLET PRODUCTION

(Publication No. 21,283)

Leo Paul Gagnon, Ph.D.
Purdue University, 1957

Major Professor: H. George DeKay

Since its invention, the compressed tablet has become a widely accepted dosage form of medication. The importance of this subject is self-evident when one acknowledges the fact that the tablet industry today is a multi-million dollar enterprise. New developments are constantly being reported and the art of tablet making has steadily grown into a highly specialized science.

This project concerns itself (1) with the development of a method for the determination of forces and resulting pressures on upper and lower punches during the tableting process and (2) with a study of granulation size, using a conventional type single punch tableting machine. Statistical treatment was applied where it was deemed feasible for analyzing data and to corroborate observations.

The principles involved in the instrumentation are based on stress analysis making use of the SR-4 electric resistance strain gage. SR-4 gages were installed on the small diameters of steel punches in such a manner as to measure the forces involved in tableting. The punch units were calibrated by applying known loads using a 60,000 pound hydraulic testing machine and noting the output on a Baldwin Portable Strain Indicator. Two Brush BL-310 Strain Analyzers and a BL-202 Double Channel Magnetic

Recording Oscillograph were utilized for measuring and recording the output during tabletting operations. The oscillograph recordings were then converted into force readings by applying calibration data.

Granulations of sodium bicarbonate, lubricated with 1% magnesium stearate and unlubricated, in mesh size ranges of 12-20, 20-30, 30-40, 40-60, and 60-80 were employed in tabletting. Data were collected on a tablet per tablet basis.

The instrumental apparatus offers a high degree of accuracy in the determination of forces involved during tabletting operations.

A linear relationship was found to exist between upper and lower punch forces during tabletting and the ratio of the latter to the former can be used as an index of tablet lubrication under actual tabletting conditions. Using the ratio of lower punch force to upper punch force as an index of lubrication, it was found that granulation size and interaction of granulation size with the lubricant have little effect on tablet lubrication when compared with the effect of the lubricant.

Striking fluctuations in tabletting pressures were found to exist within an individual run, decreasing with a decrease in granulation size. Also a strong correlation was found to exist between tablet weight and tabletting pressure, the stronger relationship being with larger granulation size.

There is a trend from greater variability toward less variability in tablet weight as granulation size decreases with unlubricated granules giving more variability in tablet weight than lubricated granules.

144 pages. \$2.00. Mic 57-2518

THE DESIGN OF AN INTEGRATING SPHERE REFLECTOMETER AND THE STUDY OF CERTAIN APPLICATIONS OF REFLECTOMETRY TO PHARMACEUTICAL PROBLEMS

(Publication No. 21,297)

Charles Wayne McKeehan, Ph.D.
Purdue University, 1957

Major Professor: John E. Christian

A study was undertaken to investigate possible applications of reflectometry to Pharmacy. The literature is practically devoid of any such applications, although there are many published applications to the food, dye and paper industries.

An integrating sphere reflectance attachment was built for the Beckman DU spectrophotometer. The design of the instrument was based on publications in the literature concerning the use and theory of reflectometers.

The apparatus was then applied to the problem of determining color stability in an ointment. The ointment was a bentonite hydrosol colored to blend with the skin, containing sulfur and resorcinol as the main therapeutic agents. Samples of the ointment containing different concentrations of sulfur and resorcinol were aged at room temperature and 55°, 60°, 65°, 70° and 75° C. in constant temperature ovens. Samples were removed periodically and their reflectances measured.

Plots of reflectance against time on semi-logarithmic paper produced straight lines for nearly all temperatures and concentrations. Rate constants were calculated from the slope of the line expressing the rate of decrease in reflectance with time at each elevated temperature. A graph of the logarithm of the rate of decrease in reflectance versus the reciprocal of absolute temperature was linear, indicating that the process follows the Arrhenius relation of rate constant to absolute temperature. By extrapolation of this line, a rate constant of 6.2×10^{-7} hours⁻¹ at 25° C. was found. This value was used in the first order reaction rate equation for predicting the color stability of the preparation.

Reflectance measurements were also made on coated tablets. A method for accurately reproducing the optical geometry for each reading has been described. Techniques for measuring differences of reflectance in coated tablets were presented.

The application of reflectometry to the investigation of color control in powders and granules was studied. Reflectance values for a single shade of face powder manufactured by different companies were shown to vary considerably. Reflectance measurements on a tablet granulation, both as granules and in pellet form, were presented.

144 pages. \$2.00. Mic 57-2519

THE ANTAGONISM OF NARCOTICS BY L-3-HYDROXY-N-ALLYLMORPHINAN (LEVALLOPHAN), L-3-HYDROXY-N-PROPARGYLMORPHINAN (PROPALLORPHAN) AND 2,4-DIAMINO-5-PHENYLTHIAZOLE (DAPTAZOLE)

(Publication No. 21,550)

Robert Megirian, Ph.D.
Boston University Graduate School, 1957

Major Instructor: Chester W. White, Jr., M.D.

In this study, propallorphan (L-3-hydroxy-N-propargylmorphinan, Ro-1-7780) was found to be a potent antagonist to alphaprodine in both dog and man. The depression of general responsiveness (objective signs of central nervous system stimulation or depression) in conscious dogs by morphine and alphaprodine was reversed by propallorphan; while in anesthetized dogs, the changes in blood and expired gases as well as respiration brought about by alphaprodine were also antagonized by propallorphan. In another series of experiments, ratios of propallorphan to alphaprodine of 1:75 or 1:100 prevented the respiratory depression normally produced by the narcotic alone. It was also found that this antagonist reversed the respiratory depression produced by morphine; the effect lasted for a period of 30 minutes only before the opiate induced depression was reinstated.

In the human studies, alphaprodine at doses of 0.375 to 2 mg./kg. were combined with the narcotic antagonists levallophan (L-3-hydroxy-N-allylmorphinan) or propallorphan for postoperative medication. Ratios of the latter drugs to the former varied from 1:100 to 1:5. Ratios of 1:100 and 1:50 produced a significant fall in respiration, while at ratios of 1:37.5 or higher, both antagonists were

equally effective in preventing respiratory depression by the narcotic. Although the relief from pain produced by the combined medication at ratios of 1:100 to 1:25 still appeared adequate, the ratios of 1:37.5 and 1:25 were most favorable since respiration was not depressed. Although ratios of 1:10 and 1:5 prevented respiratory depression, side effects increased and relief from pain appeared inadequate. With admixture of levallorphan at a ratio of 1:25, alphaprodine 2 mg./kg., an ordinarily unsafe dose, produced no significant respiratory depression.

Meperidine at a dose of 1.5 mg./kg. combined with levallorphan or daptazole was also studied in postoperative patients. Ratios of levallorphan to meperidine of 1:120 to

1:15 were tested. While meperidine alone produced a significant depression of ventilation, the 1:120 caused a smaller depression and the 1:60, 1:30, and 1:15 ratios completely prevented a reduction in respiration. The ratio of levallorphan to meperidine of 1:60 appeared most favorable, producing adequate relief from pain without respiratory depression or other undesirable side effects. By contrast, daptazole (2,4-diamino-5-phenylthiazole) failed to alter the respiratory depression caused by meperidine.

Morphine alone or in combination with levallorphan at ratios of 1:10 or 1:5 did not show a significant change in ventilation when compared to saline controls.

86 pages. \$2.00. Mic 57-2520

PHILOSOPHY

IMAGISM IN LOCKE, BERKELEY, AND HUME

(Publication No. 21,408)

John Whitney Davis, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor George D. W. Berry

Locke, Berkeley, and Hume – referred to as “the classical British empiricists” – are examined for the extent to which a doctrine, called “imagination” by Price, played a formative role in their philosophies. Imagination as defined has two main varieties, the polemical version and the constructive version. According to the former, images are the primary symbols in thinking and all other symbols are secondary and derivative. According to the latter, thought is the manipulation of mental images. It is this latter doctrine which is demonstrated as applicable to the classical British empiricists; so far as the former doctrine appears at all, it is an aberrant doctrine.

Some psychological researches into imagery conducted since the time of the classical British empiricists were germane to this inquiry. The imageless-thought controversy, Titchener’s attempted defense of the context theory of meaning (because of its similarity to Berkeley’s view), and several experiments designed to test the possibility of the formation of generalized images are discussed. In general the upshot of such studies, so far as they are relevant to this inquiry, is that the classical British empiricists were factually wrong in certain contentions concerning the role of images in mental life.

The classical British empiricists’ version of imagination is shown to be central to each one’s defense of empiricism. Demonstration of this point required specification of the kind of empiricism held by Locke, Berkeley, and Hume. Empiricism had to be distinguished from both compositionism and sensationalism. Imagination is displayed in connection with the doctrine of abstract ideas; the main lines of the controversy in classical British empiricism over abstract ideas are traced.

In order to evaluate the modern usage of the term “imagination” as contrasted with the traditional terms that were employed, a comparatively non-polemical semantic

formulation of nominalism, conceptualism, and realism is given. According to this semantic formulation, the problem of universals is a question of the entities which will be allowed to stand as values for variables. In a nominalistic language only concrete entities can stand as values for variables; in a platonistic language both abstract entities and concrete entities can stand as values for variables. Conceptualism, however, has several sub-varieties, some of which are committed to platonistic languages and some of which are committed to nominalistic languages. Examination of the three thinkers reveals that no one of them can be said to hold an authentic nominalism by the standard of ontological commitment. (Historically it is Hobbes who best exemplified the nominalist position.) Imagination is a useful term in describing the position of Berkeley and Hume, but by the standard of ontological commitment here discussed, conceptualism (in any version applicable to the classical British empiricists) is also accurate, since there is no necessary conflict between the doctrines.

The differences in the imagination of the three are quite marked. In Locke the doctrine is implicit. In Berkeley, it is fully developed, but is only partial because of the non-imagination doctrine of the notion. In Hume the doctrine is rendered fully consistent and its difficulties are correspondingly more obvious. Each of the three thinkers has difficulty in sustaining his imagination. It is suggested that their difficulties do not spring from a lack of ingenuity, but are a result of inherent difficulties in the doctrine.

Imagination, as all of them hold the doctrine, requires that the contents of consciousness be described entirely in sensory and imaginal terms. The task of maintaining this position seems insuperable. At root, the difficulty stems from a failure to hold to the distinction between imagination and conceivability. All that can be imagined can be conceived; but not all that can be conceived can be imagined. Berkeley and Hume, in particular, try unsuccessfully to subsume conceivability under imagination.

525 pages. \$6.70. Mic 57-2521

THE STATE AND THE PERSON IN THE

THOUGHT OF ALBERDI AND CASO

(Publication No. 21,551)

Carl Patton, Jr., Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor John H. Lavely

The problem of the relationships between the person and state has been a persistent one in Latin American politics and thought. The problem of this investigation is the relationship between the person and the state in the thought of two modern Latin-American philosophers, Juan Bautista Alberdi (1829-1884) and Antonio Caso (1883-1946).

Alberdi's basic point of departure was his resistance to the Rosas dictatorship. In his Las Bases y Puntos de Partida para la Organización Política de la República Argentina Alberdi sets forth the basic organization and the concept of freedom on which the Argentine Constitution is still patterned. As the defender of early Argentine Republican freedom, Alberdi occupied a similar place in Argentina to that which Hamilton or Jefferson occupied in this country's history.

Antonio Caso, using the teachings of James and Bergson, opposed the prevalent Comtean positivism. Like Alberdi, Caso struggled against dictatorship; namely, the Diaz regime in Mexico. Caso defends the human person against encroachments by the state in his finest work La Persona Humana y el Estado Totalitario.

The substance of this investigation can be expressed in terms of the chief agreements and disagreements in the positions of the two men. (1) They agree that persons should never be subjugated to the state. (2) They hold a common view of representative government. (3) Both men

had legal backgrounds which colored their social philosophies and gave them a deep sense of justice where persons were concerned. (4) They held to the same essential functions of the state. (5) Both Alberdi and Caso defend freedom of religion, (6) support faith in progress, (7) and advocate adequate educational programs.

They differ in (1) their metaphysical foundations; Alberdi's thought reflects "positivistic" tendencies, while Caso is an unsystematic eclectic idealist. (2) They hold different viewpoints about the nature of the human person: Alberdi believes in a legal person and Caso maintains a metaphysical person. (3) They have different proposals about the place of the state in society: Alberdi makes specific proposals following the liberal traditions of Adam Smith while Caso is interested primarily in the theoretical and moral basis for the state. (4) The men differ in their actual experiences in life since Alberdi spent most of his life as a lawyer, businessman, and diplomat and Caso remained in the academic life as a university professor and administrator.

Although Alberdi and Caso operated with different philosophical assumptions they have relatively harmonious views of the person and his relationship to the state. Both persistently affirmed their belief in human persons as the basic units of value in society. Human value grows out of the belief that man is a creation of God and that associations formed by men must conform to the ideals of freedom, justice, and respect found in the Hebrew-Christian tradition.

Thus each of these Latin-American social philosophers defends the liberty and freedom of the person against all authoritarian persons and institutions. Alberdi and Caso have made great contributions to their own countries and can contribute significantly to our understanding of Latin-America.

258 pages. \$3.35. Mic 57-2522

PHYSICS

PHYSICS, GENERAL

THE ELASTIC CONSTANTS OF SILVER ALLOYS
(PARTS I AND II)

(Publication No. 20,938)

Roger Bacon, Ph.D.
Case Institute of Technology, 1956

The elastic constants of single crystals of silver and of dilute alloys of silver have been measured by the ultrasonic pulse echo method. When the solute element is to the right of silver in the periodic table, there is a large fractional decrease, upon alloying, in the shear constant $(C_{11} - C_{12})/2$, and a relatively small decrease in C_{44} . This has been interpreted as indicating a decrease in the short-range crystal forces, due to a weakening of nearest neighbor repulsive bonds, and an increase in the long-range electrostatic forces, due to an increase in the average ion-core charge.

50 pages. \$2.00. Mic 57-2523

STRUCTURE OF LIQUID TELLURIUM,
SELENIUM AND INDIUM ANTIMONIDE

(Publication No. 21,273)

Robert Cecil Buschert, Ph.D.
Purdue University, 1957

Major Professors: I. G. Geib, K. Lark-Horovitz

The structures of liquid Tellurium at 465°C and 310°C , liquid Selenium at 235°C and 310°C , and liquid Indium Antimonide at 540°C have been investigated by X-ray diffraction. The scattered intensities from a free sample surface in a hydrogen or helium atmosphere were measured for monochromatic copper K and molybdenum K radiation with a counter spectrometer employing either a geiger counter or a proportional counter with discrimination.

Atomic radial distribution functions were obtained by Fourier analysis of the corrected intensity functions. In addition, electron distribution functions were calculated. Although the latter show reduced subsidiary maxima, the

main features of the atomic radial distribution functions were unchanged.

The radial distribution curve for Te at 465°C shows 2.3 atoms at a distance of 2.93A and further peaks at 4.4 and 6.3A. For Te at 610°C, there is evidence of the appearance of a new peak at 3.5A and the second peak at 4.4A is smaller. The radial distribution for liquid Se at 235°C shows 2.3 atoms at 2.36A with a further major peak at 3.7A. This distribution does not change significantly with increase in temperature to 310°C.

For liquid InSb, the distribution curve shows 6.5 atoms at 3.13A and additional peaks at 6.3 and 9.2A.

These results indicate that in the case of Te and Se there is a chain or ring structure in the liquid. This structure seems to change in the case of Te at higher temperature. Liquid InSb has structure that is typical of a molten metal.

134 pages. \$2.00. Mic 57-2524

EFFECTS OF THE COULOMB INTERACTIONS ON THE LATTICE VIBRATIONS OF CUBIC METALS

(Publication No. 21,516)

Clifton Bob Clark, Ph.D.
University of Maryland, 1957

Supervisor: Richard A. Ferrell, Ph.D.

It has been shown previously that a phenomenological model involving electron-lattice interactions gives a more satisfactory theory of the low-temperature specific heat of metals having a cubic lattice structure, than theories in which this interaction is not taken into account. Investigations have been made in this work seeking an understanding on a "first principles" basis, of the electron-lattice interaction and its effects.

A Born-von Kármán model for simple metallic elements with cubic lattice structure which considers only central force interactions between nearest and next-nearest neighbors will be referred to as a spring model. A derivation is given of the equations of motion of an ion in both body and face centered cubic (bcc and fcc) lattice structures for the spring models. A Thomas-Fermi statistical treatment yields the force on an ion due to the change in Coulomb potential energy when the ions and electrons are displaced from equilibrium, as by long-wavelength thermal or sound waves. This force is added to that obtained from a spring model yielding the force on an ion from the spring-plasma model. The spring-plasma model equations of motion involve a "coefficient of following" which indicates the response of the conduction electrons to lattice waves changing the ion density, as a function of the wavelength. Details are given for obtaining the Debye temperature function to second order in temperature beginning with the secular equation whose solutions give the square of the frequency of normal modes as polynomials involving the second and fourth powers of the wave number. The Debye temperature at absolute zero is obtained for both the bcc and fcc lattice structures. The curvature of the Debye temperature function at absolute zero is obtained for the case of elastic isotropy. The electron-lattice interaction is found to contribute about 0.3

percent to the curvature for reasonable elastic constants. The small contribution is caused by the dominance at low temperatures of normal modes which do not change the ion density (pure transverse modes). For the case of anisotropy, the effect would be increased since the dominant modes have components causing a change in the ion density.

Another model (the uniform background model), consisting of point charges of like sign in a bcc lattice which is embedded in a uniform charge of the opposite sign, is studied. The equations of motion of a point charge involving Ewald lattice sums are obtained for space-periodic distortions. The dispersion relations (circular frequency as a function of propagation vector) are determined for the propagation vector in the 100, 110, 111, and 210 directions by numerical calculation of the Ewald sums. A comparison is made with the corresponding dispersion relations obtained from the spring model with constants evaluated in terms of the Ewald sums found by Fuchs for the case of uniform distortions. Other more general properties and the extension to a model with a responding background are discussed.

The interaction of a temperature-dependent Fermi distribution of electrons with lattice phonons at low temperature is investigated by means of Schrodinger's quantum mechanical second order perturbation theory. A quantitative estimate of the departure of the electron specific heat of a simple metal like sodium from a linear dependence on temperature is obtained. The departure is found never to exceed a few percent in the temperature range from absolute zero to about one third the Debye temperature.

110 pages. \$2.00. Mic 57-2525

FUNDAMENTAL OPTICAL ABSORPTION IN MAGNESIUM OXIDE

(Publication No. 21,103)

Gilbert Henry Reiling, Ph.D.
University of Missouri, 1957

Supervisor: Eugene B. Hensley

A one-meter normal incidence concave grating vacuum spectrophotometer was constructed for the study of the band structure of solids. The spectrophotometer employed a low voltage 200 watt hydrogen arc as a light source. Ultraviolet light was detected by a photomultiplier sensitized with sodium salicylate and was automatically recorded. With the hydrogen lamp as the light source, the instrument had a useful range from 6 ev to 13 ev.

Several thin untreated Norton and Missouri University grown MgO crystals from 0.68 mm to 0.17 mm thick were measured. A sharp increase in absorption was observed at 7.4 ev and continued to at least 13 ev. In all crystals measured the absorption constant was greater than 500 cm^{-1} at 7.5 ev.

Reflectivity measurements at room temperature on Norton and M.U. cleaved crystals showed a sharp peak at 7.55 ev and two broad peaks at 11 ev and 13.2 ev. In general, the reflectivity peaks were similar in both the Norton and M.U. crystals.

Opacity measurements were made on thin films of MgO. These films were prepared by oxidizing magnesium which

had been evaporated on polished LiF plates. The curves exhibited a rise in absorption at 7.5 ev in all films studied. With regard to low incident photon energy, a sharp peak occurred at 7.95 ev and a broad peak was present at 8.8 ev. These peaks were shifted to higher photon energies at -170°C but little sharpening occurred. Another broad peak occurred between 10.5 ev and 11 ev depending on the sample. Thickness measurements of the thin films shows the absorption constant was of the order of 10^5 cm^{-1} .

Unbacked MgO films which were made by oxidizing magnesium metal were also studied. In general, the absorption curves were similar to the backed films. The first peak occurred at 7.75 ev and broad rise was observed peaking at 8.8 ev. Two broad maxima were present at 11 ev and 13.2 ev similar to the reflectivity curves.

On the basis of the above work, it appears that the substrate of the MgO films effects the position of the low energy (exciton) peak without significantly changing the structure. Considering the theory and previous work, it is suggested that the width of the forbidden gap in MgO is slightly less than 9 ev. The 11 ev and 13.2 ev maxima probably can be attributed to a variation in the density of states in the valence band or conduction band.

139 pages. \$2.00. Mic 57-2526

ON THE KINETIC ENERGY OF MOLECULAR ELECTRONS AND THE POLARIZABILITY OF MOLECULES AT LOW DENSITIES

(Publication No. 21,536)

Anson Donald Solem, Ph.D.
University of Maryland, 1957

Supervisor: Dr. L. Jansen

In this thesis the density dependence of the kinetic energy of molecular electrons and of the dielectric constant of nonpolar gases which arise because of long-range, electrostatic multipole interactions between molecular charge distributions are considered on a theoretical basis. These considerations are limited to systems of nonpolar, axially symmetric molecules and to densities so low that only pair collisions of molecules need be considered. The multipole interactions are also limited to terms involving multipoles no higher than quadrupoles.

The interaction between neighboring charge distributions is developed as a power series in terms of the separation between molecular centers; it is expressed in a vector-tensor representation involving the different multipoles of each of the molecules and the interaction tensors $T^{(l)} = -\nabla^l \left(\frac{1}{r}\right)$. This interaction is used as a perturbation Hamiltonian to compute contributions to any molecular operator function. Contributions through third order are given for the dipole vector of molecular charge distributions of axial symmetry. The statistical averages of molecular operator functions over a canonical ensemble are developed in terms of the characteristic $H-$ functions. The interaction potential can include an arbitrary, empirical Lennard-Jones function as well as the multipole interaction terms, so that the contributions arising from the different force fields between the molecules can be compared.

For computing the change of kinetic energy of molecular electrons as a function of density the virial expression in terms of the intermolecular potential is used which can include both spherical and directional fields. The directional field is taken to be small compared to the spherical field and is treated as a perturbation to the spherical field. Usual forms for the different directional fields have been assumed and statistical averages linear in the density for different order contributions to the change of kinetic energy are obtained. The calculated changes are compared to experimental changes for several molecular species. The agreement is good for limiting small densities; but the nonlinear behavior of the experimental values becomes evident at densities as low as 40 Amagat.

In considering the polarizability, the dipole moment linear in the externally applied field has been evaluated up to third-order perturbation in electrostatic interactions including quadrupole-quadrupole fields. From this the density dependent contributions to the polarizability have been obtained for the different interaction fields. The collective behavior of the polarizability in a low density statistical ensemble of molecules has been investigated by means of the Clausius-Mossotti expression. General expressions are derived in which the "fluctuation" effect and the "polarizability" effects can be compared. As an application of the general theory, these corrections to the Clausius-Mossotti function have been computed for spherical molecules, assuming a Gaussian distribution to approximate the negative molecular charge distributions. The calculated correction for argon appears to fit the experimentally observed behavior of the Clausius-Mossotti function reasonably well. The experimental results do not permit accurate comparison at limiting small densities.

122 pages. \$2.00. Mic 57-2527

PHYSICS, ELECTRONICS AND ELECTRICITY

THE ELECTRICAL CONDUCTIVITY AND CURRENT DENSITY IN THE TROPOSPHERE

(Publication No. 21,526)

James Henry Kraakevik, Ph.D.
University of Maryland, 1957

Supervisor: Professor Jules de Launay

An experimental investigation of atmospheric conductivity and current density variations with altitude, geography, and time in fair weather and relatively uncontaminated areas is discussed. Results of measurements made by means of aircraft above the surface exchange layer are analyzed in order to separate universal effects from those due to local meteorology.

The present status of fair weather atmospheric electricity is summarized. The relations between conductivity, columnar resistance, potential gradient, current density, potential, and space charge density are considered. The equations of ion equilibrium and the theory of volume recombination are used to calculate conductivity. The theory

of turbulence is applied to the calculation of convection currents. Past measurements are reviewed and their inconsistencies noted.

Instrumentation of a P4Y aircraft to measure both polar conductivities, simultaneously with potential gradient and other atmospheric electric and meteorological variables is described. The effects on the conductivity measurement of aircraft charge and triboelectric charging of the conductivity chamber central electrode are discussed.

Of 31 flights 22 successful fair weather profiles were obtained. Results of these measurements, made in an altitude range from .015 to 6 km, and in areas extending from the Gulf of Mexico to Greenland and from Bermuda to the California coast are presented.

The conductivity is always found to increase exponentially with altitude above 3 km, and over the entire altitude range in the clean air of Newfoundland and Greenland. It is shown that deviations from this exponential variation are determined by the vertical distribution of condensation nuclei. The average ratio of negative to positive conductivity above the exchange layer is found to be 1:1. The diffusion of small ions to atmospheric particles is invoked as a mechanism for reducing the conductivity ratio from the mobility ratio. The extrapolated total columnar resistance is found to vary geographically from 7.4×10^{18} ohm-m², and diurnally up to 40 per cent, depending on the amount of contamination. Its average value over the oceans is 9.3×10^{18} ohm-m².

The conduction current density within 15 m of the earth's surface is found to be some 30 per cent higher on the average, and 100 per cent higher in some cases, than that above the exchange layer, due to the upward convection of positive space charge. Above the exchange layer the conduction current density is constant to within + 10 per cent. It is found to vary geographically from 1.4×10^{-12} amp/m² with an average value of 2.72×10^{-12} amp/m² over the oceans. No decrease is observed at the higher altitudes indicating that the horizontal current flow from thunderstorm to fair weather areas occurs above 6 km. The current density above Greenland is found to vary diurnally + 15 per cent about the mean value, in excellent agreement with ocean surface hourly averages. It is shown from simultaneous surface and airborne measurements that surface measurements do not provide a valid index of world-wide effects but give significant results only on a statistical basis.

Considering the earth and the high atmosphere as a spherical condenser, the positive potential of the high atmosphere is found to be 290 kv; the total resistance is 200 ohms; and the world-wide conduction current is 1400 amps. The 10 kv discrepancy between the 290 kv potential and the product of current and resistance is real and indicates the average effect of convection within the exchange layer.

213 pages. \$2.80. Mic 57-2528

TIME DEPENDENT MOTION OF A CONDUCTING SHEET OF LIQUID IN AN ELECTROMAGNETIC FIELD

(Publication No. 21,558)

Wallace Samuel Kreisman, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Walter Hauser

The basic objective of the dissertation was to derive and solve the time dependent one dimensional equations of motion for an infinite sheet of viscous, incompressible, conducting liquid of finite thickness. The liquid is acted upon by a transverse spatially homogeneous magnetic field, by current from an external source, and by mechanical pressure gradients. Two simultaneous, linear, partial differential equations were derived which give the relationship between the fluid velocity $v(x,t)$ and a "reduced" variable $h'(x,t)$. This latter variable is proportional to the induced magnetic field $h(x,t)$ but has the dimensions of a velocity.

To obtain as much generality as possible, it was assumed that the mechanical and electromagnetic driving terms could be expressed either in terms of Fourier series or Fourier integrals. The system equations were first solved for an arbitrary, single-frequency, complex harmonic driving function. The solutions for driving functions expressible as a sum or integral of complex harmonic terms become simply the corresponding sum or integral of the solutions for the individual harmonic components.

Special attention was given to the two important cases in which the driving terms are either constant or sinusoidal. In the former case, it is shown how Hartmann's two steady state solutions depend on the induced magnetic field boundary condition. It is pointed out that Hartmann's solutions are really one-dimensional approximations of a two-dimensional problem. In the latter case, the system equations are similar to those for coupled circuits and the solutions exhibit a phase lag for v and h with respect to the driving pressure gradients.

Both solutions are shown to vary in transcendental fashion with the value of the dimensionless parameter that has been labelled by the letter M in recent work by Shercliff and Murgatroyd. A dimensional analysis reveals that M^2 is the ratio between the electromagnetic and viscous forces per unit volume of the fluid, a fact that was overlooked in Lehnert's recent work.

The complete solutions of the system equations were found by making use of the Laplace transformation technique in combination with Fourier series expansions. The transient portions of the solutions involve two exponential terms. It is shown how these solutions may be simplified when they are applied to liquid metals under conditions ordinarily existing in laboratory work.

Several examples are worked out which illustrate the acceleration from rest to a steady state condition of sheets of liquid mercury. It is found that the fluid velocity and induced magnetic field approach their steady state values in a smooth, monotonically increasing, exponential fashion, provided that a certain inequality exists between various parameters of the system. When this inequality is violated, as it may be, the approach to steady state becomes an oscillating, exponential approach.

A separate chapter is devoted to a derivation of the system equations for two-dimensional magnetohydrodynamic motion in rectangular channels. It is assumed that a charge distribution develops in the fluid. The resulting set of partial differential equations is non-linear.

Some experimental work concerning the movement of mercury electromagnetically is described. Results are reported which confirm the order of magnitude of liquid mercury motion under conditions similar to those assumed in the theoretical examples.

159 pages. \$2.10. Mic 57-2529

**AN EXPERIMENTAL INVESTIGATION
OF BRILLOUIN FLOW**

(Publication No. 21,577)

Harold Emanuel Petersen, Ph.D.
Stanford University, 1957

This report presents the results of a predominately experimental investigation of an axially-symmetric electron beam in Brillouin flow.

Theoretical analyses are presented to show the behavior to be expected for various conditions. This includes work by Moster and Molnar which takes into account the effect of a finite shield opening, and the consequent non-abrupt rise in magnetic field strength.

The design, construction and operational capabilities of a beam analyzer are presented. By employing an iris, the beam distribution within the confines of a drift-tube is investigated under conditions similar to those in standard beam systems. A unique pulse measuring system was employed which permits continuous measurements on a pulse basis.

The results of the experimental investigation verify quantitatively nearly all of the theory presented for Brillouin flow. The single exception is the correction for the effect of a finite magnetic shield opening where a difference of a factor of four is noted. The experimental results show that parallel Brillouin flow is possible and that it occurs at the theoretically predicted value of magnetic field strength. On the basis of the results obtained it seems that the larger field strengths usually required for satisfactory transmission are due to an incorrect location of the magnetic shield.

92 pages. \$2.00. Mic 57-2530

**RESOLVING POWER OF AN ELECTROSTATIC
ELECTRON SPECTROMETER**

(Publication No. 21,539)

William Edward Waters, Jr., Ph.D.
University of Maryland, 1957

Supervisor: Dr. L. Marton, Professor Part-time

The energy resolution of an electrostatic electron spectrometer which makes use of high off-axis chromatic aberration to obtain high resolution has been calculated. Numerical integration of the equations of motion of electrons

has been performed by a digital computer, and the computed trajectory coordinates have been used to determine the resolution. The potential distribution of the spectrometer was constructed theoretically; this distribution is represented by the function

$$V(x,y) = 30,000 \left[1 - 2A(\cos x \cosh y) / (\cos 2x + \cosh 2y) \right] \text{volts.}$$

Using a standard set of collimating conditions in the electron gun of the instrument, it has been computed that an energy resolution in excess of 1.4×10^6 may be obtained; this figure is nearly an order of magnitude greater than has been reported experimentally in similar equipment. However, certain uncertainties concerning the exact collimating conditions in the experimental apparatus exist; in view of these uncertainties a direct comparison of the theoretical and experimental results is not possible. Certain other factors which may limit the obtainable resolution in an actual apparatus are also discussed; one of the most important of these appears to be the spread in the initial energies of the electrons as they are emitted from the thermionic source.

It is shown that the factors which tend to produce very high chromatic aberration (separation on the image plane of groups of electrons having small distinct differences in their initial energies) also tend to produce large magnification of the virtual electron source. As a result a direct comparison of the resolution of instruments which have a given large value of chromatic aberration cannot be made until the magnifications have also been determined. It is concluded that the class of spectrometers which make use of saddle-shaped potential distributions to obtain high off-axis chromatic aberration are inherently capable of high resolution.

The elements of a perturbation technique for calculation of electron paths are presented. The resulting formulas may be used to calculate the separation of two electrons which move (always close together) through a two-dimensional electrostatic field, provided the path of one of the two has been determined, and provided the small differences in their initial conditions is stated. The practicality of using these formulas to calculate actual performance of a device is discussed, and a detailed example of the use of these formulas to interpret the physical behavior of an electrostatic device is given.

Integral formulas are derived, the use of which permits the construction of solutions of Laplace's equation, plus location of the sources, given the variation of the potential and its normal derivative along an infinite straight line in the plane. Several examples of the use of these integrals are also given. A brief discussion of the Runge-Kutta method of numerically integrating systems of ordinary differential equations is included.

121 pages. \$2.00. Mic 57-2531

PHYSICS, NUCLEAR

DISTORTIONS OF ATOMS AND MOLECULES IN DENSE MEDIA

(Publication No. 21,518)

John Myrick Dawson, Ph.D.
University of Maryland, 1957

Supervisor: Z. I. Slawsky

This thesis deals with the distortions which are produced by molecular interactions in the electronic structure and vibrational motions of a molecule. The following are the main topics considered.

I. A method for attacking such problems is developed. The method combines both the variational and perturbation methods of Quantum Mechanics.

II. The effect of intermolecular interactions on the electronic kinetic energy within the molecules is discussed. The discussion is based on the application of the virial theorem to the problem of molecular interactions. The results are quite general and apply to all molecular interactions which are not so violent as to produce electronic excitation.

III. The effects of intermolecular forces on the electronic structure of hydrogen are calculated. Here three main problems are considered.

(a) The effect of the London dispersion force between two hydrogen atoms on their electronic structure is calculated.

(b) The effect of embedding a hydrogen atom in a dielectric media is considered. This problem is intended to give a model for determining the average effect of the attractive forces between a hydrogen atom and its neighbors on its electronic structure.

(c) The effect of a perturbing potential of the form $A P r^3$ on the electronic structure of hydrogen and helium is determined. It is assumed that the effects of such a potential are similar to the average effects produced by pressure. A comparison of the results for helium and experimental results is given.

IV. The effects of intermolecular forces on the internuclear spacing and vibrational frequencies of H_2^+ are calculated. Here also three problems are considered.

(a) The effect of the Van der Waals force between an H_2^+ molecule and a second molecule on the internuclear spacing and vibrational frequency of H_2^+ are calculated.

(b) The effect of embedding an H_2^+ molecule in a dielectric is investigated. As with hydrogen this is meant to be a model for a molecule in a dense gas or liquid. A shift in the vibrational frequency of about one per cent towards lower frequency is found when a reasonable value for the dielectric constant is taken. This is of the same order of magnitude as the shifts found for molecules in a liquid.

(c) The effects of a perturbing potential of the form $A P R r^3$ on the internuclear spacing and vibrational frequency of H_2^+ are calculated. These effects are assumed to be similar to those produced by pressure. It is found that pressures of the order of 100,000 atmospheres are required to produce appreciable effects.

V. The effect of caging on the vibrational energy levels of a diatomic molecule is calculated. It is assumed that in a dense gas or liquid the neighboring molecules to

a given molecule form a cage in which the molecule is confined. The calculation gives an estimate of this effect on the vibrations of a molecule. It is found that the effect is small.

95 pages. \$2.00. Mic 57-2532

ANGULAR CORRELATION MEASUREMENTS IN Sn^{117} AND Ag^{105}

(Publication No. 20,787)

Robert K. Golden, Ph.D.
University of Pennsylvania, 1957

Supervisor: Sherman Frankel

The decay of the nuclear isomer, Sn^{117} , occurs in two steps in the form $h\ 11/2 \rightarrow 3/2 \rightarrow 1/2$. The angular correlation, between the K converted electron from the 159 Kev gamma in the first transition and the 162 Kev gamma in the second transition, was obtained with a thin lens beta spectrometer and a gamma detector, using coincidence circuits with resolution times of the order of 10^{-7} seconds.

The low specific activity of Sn^{117} required the deposition of thick sources of large diameter. These were four non-uniform deposits, 1 cm in diameter (maximum), ranging from 3.5 to .35 mg/cm² thickness, on backing films of glass and Al of the order of 200 $\mu g/cm^2$ thickness.

Since the 130 Kev electron was elastically scattered in these sources, it was necessary to determine how the correlation was affected by the thickness, and how the spectrometer responded to regions of the source off the axis.

A transmission efficiency function, $f(r)$, of the spectrometer was obtained which described the variation in transmission with r , the distance from the spectrometer axis. Underexposed radiograms of the sources were examined in a sensitive optical densitometer to obtain a relative thickness function, $d(r)$, of each source. The scattering and degree of wipeout of the correlation, due to each source, was then determined using the method of Frankel. The data obtained extrapolated to zero wipeout factor for infinite thickness, indicating that scattering corrections for large thicknesses could be determined with far greater accuracy than previously expected.

From Rose and Biedenharn, the theoretical value of a K electron-gamma angular correlation in Sn^{117} , corrected for geometry, is $A_2 = 0.156$. The measured value of the coefficient, extrapolated to a wipeout factor of 1, is 0.136. This gives a mixture ratio of E2 radiation to E2 + M1 radiation, in the second transition, of 0.15 percent. The phase factor is 0.

Sn^{117} has the same decay scheme as Te^{121} and Te^{123} , investigated by Goldberg and Frankel. The square of the E2 matrix element for Sn^{117} , magic in protons, is one tenth of that found for Te^{123} . This is in qualitative agreement with a crude modification of the theory of Moszkowski for odd neutron electric transitions. Quantitatively, the measured value is 10^4 times larger than the theoretical prediction.

The radiation from Ag^{105} was investigated with a thin lens beta spectrometer, a fixed focus beta spectrograph and gamma-gamma triple coincidence circuitry with resolution time of 10^{-9} seconds. Both natural and enriched sources were used.

The radiation was found to consist of gamma rays with energies of 64, 155, 183, 281, 319, 332, 345, 392, 444, and 652 Kev. Relative intensities, K/L ratios and conversion coefficients were obtained for all but the weaker lines.

By means of coincidence spectra the decay scheme is constructed. The most intense sequence, 64-281 to the ground state, is given as $s\frac{1}{2} \rightarrow d\frac{3}{2} \rightarrow d\frac{5}{2}$, in conformity with nuclear model considerations. The angular correlation indicates that the transitions are M1-E2 mixtures of approximately equal magnitude. The phases are negative in the second transition and possibly positive in the first transition.

88 pages. \$2.00. Mic 57-2533

**ENERGY SPECTRUM OF ELECTRONS
PRODUCED BY BREMSSTRAHLUNG
IN ALUMINUM**

(Publication No. 21,657)

Robert L. Stearns, Ph.D.
Case Institute of Technology, 1956

Electron energy spectra produced in aluminum at depths of one half inch and four inches by 17.8 Mev. bremsstrahlung are measured at angles of 0° , 15° , 30° and 60° . This data is used to obtain an electron spectrum integrated over angles for each depth. These results are compared with the theoretical prediction as calculated by the method developed by Brysk. Agreement was obtained for both thicknesses within the experimental error which ranged from 5% to 10%. The experimental integrated positron spectra for these thicknesses are also obtained.

61 pages. \$2.00. Mic 57-2534

**THE MECHANICAL ASPECTS OF
A BETA-RAY SPECTROMETER AND
ITS APPLICATION TO THE STUDY OF
RUBIDIUM 86 AND TUNGSTEN 185**

(Publication No. 17,331)

Walter H. Wurster, Ph.D.
The University of Buffalo, 1957

An iron-free, ring focus beta-ray spectrometer of the uniform field type has been constructed for the investigation of beta spectra. Its basic design has been patterned after that of F. H. Schmidt. Details of the mechanics of the spectrometer and several important modifications are presented. These include the control and adjustment of the transmission and resolution settings of the instrument from outside the vacuum chamber, and the incorporation of a scintillation detector for gamma-rays, making possible the recording of beta-gamma coincidence spectra.

The calibration curve of electron momentum vs. magnet current is linear, as experimentally determined by focussing electrons of known momenta. The calibration constant is 106.10 gauss-cm per ampere. The spectrometer resolution varies from 0.1 to 0.9% at transmissions of 1 to 3%, respectively.

The performance of the spectrometer as a beta-gamma coincidence instrument was determined by an investigation of the spectrum of rubidium 86. The electron endpoint energies of the two components of the spectrum are in reasonable agreement with those of other investigators. The limiting factor to the usefulness of the instrument for coincidence work is shown to be the resolving time of the coincidence circuit.

The 74-day isotope of tungsten has been studied. The decay schemes reported to date have been ambiguous both as to the presence of gamma-rays and the simplicity of the beta spectrum. A search was made for direct evidence of the presence of a second beta component, whose occurrence, as inferred from intensity measurements of the gamma spectrum has recently been reported. Attempts with coincidence methods are shown to be inconclusive, due to the energies of the transitions involved, and the long coincidence resolving time. A detailed study of the high energy region of the beta spectrum was subsequently made, which revealed a break in the slope of the Fermi-Kurie plot of the spectrum. A comparable check measurement and analysis of the well-known phosphorous 32 spectrum was linear, and the break in the W^{185} curve is taken to indicate the presence of the second beta component. The endpoint energies were measured to be 428.6 ± 0.5 and 382 ± 10 kev.

91 pages. \$2.00. Mic 57-2535

PHYSIOLOGY

THE DEMONSTRATION OF A FACTOR PRODUCED BY THE OVARIES AND THE FALLOPIAN TUBES WHICH INFLUENCES THE LEVEL OF MUSCLE GLYCOGEN

(Publication No. 20,198)

Harry Alvin Kent, Jr., Ph.D.
University of Oregon, 1957

Adviser: A. L. Soderwall

Preliminary work on a comparison of striated muscle glycogen of young and old female hamsters indicated that a basic difference existed. In an attempt to elucidate the problem, the ovaries of young animals were removed and an analysis of muscle glycogen carried out. The data were compared with the findings on control animals. The results of the analyses were contradictory and indicated that an unknown factor was involved.

The problem has been attacked in the present study with the realization that, of the original operated animals, some had the ovaries alone removed while others had both ovaries and fallopian tubes removed.

The following steps were taken in a study of the effects of ovaries and fallopian tubes on muscle glycogen levels:

1. Operated control animals were prepared.
2. Bilaterally ovariectomized-fallopianectomized animals were prepared.
3. Bilaterally ovariectomized animals were prepared.
4. Bilaterally fallopianectomized animals were prepared.
5. Bilaterally ovariectomized, unilaterally fallopianectomized animals were prepared.
6. Bilaterally ovariectomized-fallopianectomized animals received implants of ovaries and fallopian tubes.
7. The ovarian arteries were ligated in a series of animals.

Extraction of muscle glycogen was by alcoholic-alkali procedures and determination by the Phenol method. Analysis of muscle glycogen demonstrated that bilaterally ovariectomized-fallopianectomized animals and those with ligated ovarian arteries had significantly less muscle glycogen than the control animals. The other groups did not differ from the controls.

The lowered muscle glycogen levels, after extirpation of both sets of glands, were observed as early as one day after operation and persisted for an observed period of ten days.

Blood sugar remains constant while blood lactic acid values drop in bilaterally ovariectomized-fallopianectomized animals, as compared to controls.

The experimental findings are discussed and an explanation offered.

43 pages. \$2.00. Mic 57-2536

GENERAL STUDIES ON ANAPHYLAXIS AND RAT HEART ANTISERUM

(Publication No. 21,574)

William Tyndall McElroy, Jr., Ph.D.
Stanford University, 1957

Experiments were designed (1) to compare anaphylactic responses in rats, mice and guinea pigs to responses elicited by histamine, and (2) to study the serological properties of rat heart antiserum and the effects of the antiserum on intact rats and isolated perfused rat hearts.

Methods - For tests on non-specific anaphylaxis, experimental animals were actively or passively sensitized to ovalbumin. An Anderson Heart Perfusion Apparatus was used to perfuse hearts; Chenoweth's solution was the perfusate. Intestinal segments were tested in chambers containing oxygenated Tyrode's solution.

Rat heart antiserum was obtained by injecting rabbits with suspensions of homogenated perfused rat heart. Serological tests on the antiserum consisted of ring tests, gel diffusion tests, antibody protein determinations, and complement fixation tests. Histamine-diphosphate and serotonin-creatinine-phosphate were the drugs tested.

Results - Rats were not sensitized for anaphylactic shock when ovalbumin was the antigen; mice or guinea pigs were actively or passively sensitized to ovalbumin. Rats were sensitized to human serum.

The minimum fatal intraperitoneal doses of histamine for guinea pigs, mice, and rats were found to be 0.1, 0.8, and 1.0 gm/kg respectively.

The signs of histamine shock in rats or mice were not the same as those during anaphylactic shock; guinea pigs responded similarly to either type of shock. Electrocardiograms of rats or mice showed only rate changes during histamine or anaphylactic shock; guinea pigs had electrocardiograms showing disturbances in conduction, and block.

Sensitized guinea pig hearts responded to anaphylaxis, serotonin, or histamine as an increase in rate, contraction amplitude, and a decrease in coronary flow; they responded to doses of histamine as small as 0.01 micrograms.

Mouse or rat intestine responded to anaphylaxis sometimes as contraction and sometimes as relaxation. The response to histamine was also variable, and large doses were required to elicit a response. Guinea pig intestine responded to anaphylaxis or histamine only as contraction.

The anti-heart serum obtained from rabbits showed antibodies specific for rat heart. Ring tests were positive for extract of rat heart, heart-myosin, and rat plasma, and doubtful or slightly positive for rat kidney. Antibodies which cross-reacted with kidney were removed by absorption with kidney. Absorption of the antiserum with rat heart removed antibodies to rat heart, kidney, and heart-myosin, but absorption with kidney did not remove antibodies specific for heart, or heart-myosin. Gel diffusion tests indicated that three types of antibodies were in the antiserum:

(1) specific for heart

2. cross-reacting with heart or kidney
3. specific for plasma

Complement fixation tests showed that the reaction between antiserum and rat heart fixed complement. Kidney-absorbed antiserum contained 3.04 mg antibody protein/ml.

Small intraperitoneal injections of anti-heart serum invariably shocked rats, and many died. Mice or guinea pigs were unaffected by similar treatment. Electrocardiograms of shocked rats showed conduction changes, and the heart rates were reduced.

Perfused rat hearts were usually killed by the anti-serum; the rate, coronary flow and contraction amplitude were reduced, and irregularities and block occurred. At least 100 micrograms of histamine were required to simulate the changes produced by the antiserum; histamine did not affect the coronary flow. The responses to serotonin were the same as those to histamine.

Conclusions — Mice or rats, or mouse or rat tissues, were highly refractory to histamine. Guinea pigs or guinea pig tissues were not. Rats were relatively difficult to sensitize and shock, but mice were easily sensitized. The responses of rat or mouse intestine to anaphylaxis were often not the same as those elicited by histamine. These findings suggest that histamine release may not be the factor involved in anaphylaxis in rats or mice.

Antibodies to rat heart were produced in rabbits; they were not the same antibodies which cross-reacted with rat kidney. Rat kidney and heart contain a common antigen, but heart contains an antigen not present in kidney.

Heart-specific antiserum shocked rats, produced changes in their electrocardiograms, and affected isolated perfused rat hearts. The antiserum was species specific for rats, compared to mice or guinea pigs.

145 pages. \$2.00. Mic 57-2537

RELATION BETWEEN HYDRATION AND ULTRAVIOLET RADIATION SENSITIVITY OF PARAMECIUM CALKINSI

(Publication No. 21,580)

David Carter Shepard, Ph.D.
Stanford University, 1957

The relation between the degree of hydration of a cell and its ultraviolet sensitivity has been investigated. Paramecium calkinsi was chosen as the experimental organism because it can withstand direct transfer over a wide range of salinities. The degree of cellular hydration of this organism can be varied by subjecting it to different osmotic environments. Division of individual isolates after irradiation with monochromatic or Sterilamp ultraviolet radiation can be readily followed. Paramecia were starved in fifty per cent artificial sea water (ASW), irradiated in either a greater or lesser percentage ASW, and grown in fifty per cent sea water lettuce infusion on a single strain

of bacteria. This organism then lends itself well to studies on the degree of hydration of the cell and ultraviolet retardation of cell division.

Starved P. calkinsi divide once or twice with a small initial delay after irradiation. Stasis of division then occurs during which time the progeny of the initial delayed division(s) do not divide again for up to two weeks. Recovery of normal division then occurs so that it is complete by the third division after irradiation. After irradiation, unstarved paramecia react similarly to starved ones, except that stasis occurs between the second and the fourth division. Photoreversal of initial delay of division after irradiation is of a lesser magnitude than photoreversal of stasis. Stasis is much more prolonged after a dose of radiation at wavelength 2654A than by an equal dose of wavelength 2804A, but the initial delay is affected to the same degree by both wavelengths.

When paramecia are transferred before irradiation to a lower percentage of ASW than the starvation solution, the length of stasis increases, whereas the initial delay after irradiation is unaffected. In more concentrated ASW, the length of the stasis period is decreased somewhat, but initial delay is unaffected. The change in UV sensitivity is truly an osmotic effect because, when ASW is largely replaced by NaCl or sucrose, similar changes of UV sensitivity occur.

Radiation sensitivity changes of paramecia are proportional to the amount of osmotic change preceding irradiation. Radiation sensitivity produced by immersion in more dilute solutions changes with time after transfer. Sensitivity to UV reaches a maximum at fifteen minutes, then decreases to a level approaching normal. The equilibrium level may be above normal or normal depending upon the original osmotic change.

Volume changes of the paramecia parallel their changes in UV sensitivity after transfer to a lower percentage of ASW. Studies on contractile vacuole function indicate that volume regulation in this organism is accomplished by increased vacuolar output of water entering through the cell surface, as well as by loss of salts.

Retardation of cell division by UV in this organism, and probably in other cells, can best be explained as an inhibition of syntheses necessary for division. It is proposed that the stasis period in ciliate protozoa is comparable to division delay in other cell types, and is therefore an effect of UV on nuclear function. Initial delay is a more generalized effect on cellular metabolism exhibited as a separate effect of UV in only a few cell types.

The parallel between hydration and UV sensitivity (stasis of division) is interpreted as a change in transmission of radiation reaching the macronucleus following swelling of the cell in dilute solutions. The initial delay preceding the first division is unaffected by osmotic change because the total number of absorbing molecules is not changed by the amount of water in the cell.

100 pages. \$2.00. Mic 57-2538

POLITICAL SCIENCE

POLITICAL SCIENCE, GENERAL

SECTION 315 OF THE COMMUNICATIONS ACT OF 1934 AND THE PRESIDENTIAL ELECTION OF 1952

(Publication No. 21,695)

Isaiah Sidney Bard, Ph.D.
New York University, 1956

The Problem

Section 315 of the Communications Act of 1934 was formulated to assure the most equitable utilization of radio's limited facilities by political parties and candidates. The purpose of this study is to determine whether it has, in practice, accomplished this purpose.

The study considers problems posed by Section 315's operation in the 1952 presidential election in connection with political parties, the F.C.C. and the broadcast industry. Proposals offered by various groups in regard to Section 315's future operation are then reviewed as they relate to broadcaster responsibility and specific goals toward which radio and TV should strive in an election year. Recommendations are finally promulgated, directed as assuring the most positive utilization of the broadcast media in future elections.

Major Findings

Section 315's provisions restricted the programming opportunities of political parties in the 1952 election. Allotment of free broadcast time to the major parties was greatly limited by the operation of its "equal opportunities" provisions in relation to splinter parties and candidates and, particularly in connection with candidate appearances, without cost to themselves, on commercially sponsored presentations. As a result of these fringe-party requirements, the networks adopted a policy of selling pre-election time, holding their allocation of free time to political groups to a minimum. The minority groups were consequently unable to exploit the potentialities of the media, utilizing radio and TV infrequently, mainly on the local level. Under these conditions, Section 315's equal time provisions lost much of their meaning.

Principal Recommendations

The study formulates specific goals emphasizing information and reasoned argument as the desiderata of political programming in an election year. It proposes that a ceiling be established on broadcast electioneering -- an agreed maximum of hours to be allotted to political broadcasts through mutual consent of the parties, the broadcasters or through F.C.C. regulation.

Passage is urged of legislation which would modify Section 315 to exclude from its equal time obligations programs of a news and discussion character whose production is controlled and supervised by the networks. Short of this, the main goal is seen as the widening of political

broadcast opportunities by requiring parties to give evidence of significant support to be entitled to free time. Groups would qualify which either received a specified number of votes in the preceding presidential election or could produce a minimum number of signed petitions demonstrating widespread support. New parties would either deposit a specified amount of money which would be forfeited should they not secure the required minimum of votes in the election or by producing a minimum number of valid petitions indicating substantial support. These criteria could be developed jointly by the broadcasters, the parties and legislators.

Since specific time would be allocated in proportion to demonstrated support, and end result would be the achievement of equitable rather than equal time. Although the major parties would thus receive the largest share of such time, minority groups would be afforded more broadcast opportunities than are presently possible.

In the area of broadcast defamation, the study recommends that Section 315 be amended to allow for the deletion by licensees of possibly defamatory remarks but prohibiting their deletion because of partisan emphasis.

In connection with a long-range view of problems in this area, it is proposed that eventually Section 315 be eliminated and the licensee permitted as full an exercise of his discretion in relation to political broadcasts as in the case with general programming. This would, of course, necessitate broadcaster acceptance of a more comprehensive review of their performance in this area by the F.C.C.

292 pages. \$3.75. Mic 57-2539

THE POLITICAL AND SOCIAL THINKING OF GEORGE BERNARD SHAW

(Publication No. 21,555)

Margaret Winifred Dower, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Robert P. Benedict

The political thinking of George Bernard Shaw was both a logical extension of and an attack on classical liberalism, for he took the seed of equality planted by Locke and extended it to economics. He agreed with the Idealists, Bradley and Bosanquet, that the state must concern itself with the interests of all the people, and with T.H. Green especially, that it must have a moral foundation. He accepted the idea of an inherent impulse in man from the utilitarians but gave it a wider base, under the influence of Lamarck and Butler, and called it the Life Force.

Henry George revealed the importance of economic justice; Marx, the extent of the evils of capitalism; Jevons and Wicksteed, the utility theory of value; Bentham, the duties of government to provide security for all; Mill, the ways in which competition might be restricted. Thus the various parts of Shaw's writings were not original, but he evolved a unique system out of these parts, overlooking no aspect of life.

The rationality of the Fabians attracted Shaw. He went beyond the Fabians in an attempt to improve not only institutions but also man's nature--a difficult task, since each was dependent on the other.

In the prewar years, Shaw based his hopes for success on the rationality of Socialism, although his doctrine always contained seeds of totalitarianism. World War I and the accomplishments of dictators led him away from Fabianism to ideas of force. World War II brought more critical attitudes toward authoritarian power.

Always, however, he emphasized the importance of relative equality of income and of government for everybody but not by everybody.

The Life Force was the power behind man operating through vital urges, enabling man to triumph over matter and to reach the goal of pure thought. Critics questioned the purpose of this goal.

Poverty, caused by the evils of capitalism, prevented the fulfillment of Life Force potentialities and caused irrationality and waste; therefore, Shaw would nationalize gradually basic industries sharing the produce with the people, leaving the industries of experimentation and novelty to private enterprise. However, beware of sham socialism that confiscated wealth for the enjoyment of a few.

Some critics believed that Shaw helped eliminate some economic evils; others, that he was unrealistic.

Political machinery necessary to bring sufficient equality of income required several parliaments with different functions, plus a central coordinating authority with a Cabinet of Thinkers and one of Administrators in every Parliament. People would vote only for those listed on selected panels. Tests, definite periods of tenure, "One Subject, One Vote," and Inquisition Panel, a State Department of Evolution, public health legislation, a Ministry of Fine Arts, responsible liberty, imperial federations, homogeneous leagues were further aspects of Shaw's program. This all powerful state contradicted Shaw's ideas on liberty and on the Life Force.

At times Shaw appeared to feel that the Soviet experiment contained humanity's only salvation. A desire to put democratic leaders on their mettle or a necessity to believe in the U.S.S.R. might have caused some extravagant Shavian statements.

Critics agreed that Shaw possessed literary skill but some believed that Shaw used that skill ineffectually.

Shaw made many excellent suggestions, such as those for a Labour Party, a League of Nations, war reparations, municipal government. His analysis of existing evils was excellent. He stimulated many. However, he was contradictory. His ideal state was incomplete. He neglected emotional factors, making no provision for irrationality among his leaders. Unknowingly, he substituted the omnipotence of man for the omnipotence of a god or of a Life Force.

320 pages. \$4.10. Mic 57-2540

CONSTITUTIONALISM AND STATECRAFT DURING
THE GOLDEN AGE OF SPAIN: A STUDY OF THE
POLITICAL PHILOSOPHY OF JUAN DE MARIANA, S.J.

(Publication No. 21,610)

Guenter Lewy, Ph.D.
Columbia University, 1957

The fame, or perhaps rather infamy, of the political thought of Juan de Mariana (1535-1624) has hitherto rested largely upon his vigorous defense of tyrannicide. The proper place of Mariana in the history of political philosophy has been obscured, in addition, by the fact that Mariana belonged to the highly controversial Society of Jesus. The purpose of this study is to achieve a more sober evaluation of Mariana's political thinking and to see it in the more appropriate setting of Spain's Golden Century.

The origin of Mariana's radicalism is to be sought in his ardent desire to restore the medieval constitution of Spain which he associated with Spain's greatness in earlier days. Mariana defended a limited monarchy not as the spokesman of a persecuted religious sect, but as a Spaniard seriously concerned over the trend toward corrupt absolutism under Habsburg rule. His political philosophy was essentially secular and utilitarian. He conceived of government as a distinctly human creation and, as one of the first modern theorists, Mariana utilized the pagan idea of a state of nature in order to build a foundation for his espousal of the right of resistance to tyranny. The state, in his eyes, had come into being to serve man's earthly wants and the community always retained the right of deposing rulers who failed to live up to the duties of their office. Unlike other Jesuits of his time, Mariana made no mention of the pope's temporal power and he defended religious uniformity primarily for political reasons. His main concern was with political stability rather than with dogmatic rightness.

Yet Mariana's political philosophy cannot be considered democratic in any modern sense. When Mariana invoked the ultimate sovereignty of the commonwealth and the subordination of the prince to the community, he had in mind the government of the Estates of the Realm - the Cortes. Questions of suffrage never even entered his mind. Mariana had considerable disdain for the multitude in whom he saw nothing but rabble and canaille. Following the medieval scholastics, Mariana deemed monarchy the best form of government and he considered man's dependence upon the aid of his fellows as a prime cause of civil society.

Mariana thus stood at the point of convergence of different influences. In his thought were blended ancient ideas and modern aspirations, strands of medieval scholasticism and modern individualism. He was a Jesuit sworn to defend orthodoxy, but himself was driven to embrace the heretical theology of Semi-Pelagianism which granted man a greater amount of moral freedom and enhanced human initiative. Mariana also played a prominent role in the Spanish rebellion against the autocratic government of the Jesuit Order.

Mariana's ideas of the right of resistance and tyrannicide, as this study attempts to show, were not new or original. Nevertheless, his forceful restatement of these old concepts did much to popularize them. During the Puritan Revolution in England, contemporaries spoke of

his book *De rege et regis institutione* as being widely read and many a Puritan was accused of following Mariana's subversive doctrines. The substance of Locke's defense of limited government can be traced back to Mariana and the entire Jesuit school of political thought.

453 pages. \$5.80. Mic 57-2541

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

FOREIGN ECONOMIC RELATIONS IN THE DEVELOPMENT OF IRAN (Publication No. 21,096)

Helen Marie Bonnell, Ph.D.
The American University, 1957

The main problem is the determination of a complementary set of factors in the field of international economic relations to accommodate development in the domestic economy. (The study does not deal specifically with the domestic economy.) The role of oil concessions in economic development constitutes a special aspect of the problem. A further, and underlying, object of inquiry is the extent to which the desired development can be achieved without the infringement of a country's independence or the adoption on the part of the country of paternalistic or totalitarian methods *vis-à-vis* the country's own citizens.

A combination of descriptive and analytical methods is used. The period studied is largely contemporary, but includes the historical background of Iran. There is considerable detail as to both the composition and the direction of trade. In the analytical portions, especial attention is devoted to the significance of balance-of-payments items in their total context, to the qualitative aspects of trade as opposed to the purely quantitative mercantilistic and multiplier approaches, and to the rationale of development on the basis of concession income and external financing. Foreign trade and financial controls are analyzed and assessed.

The study reveals that the balance of payments of Iran has typically comprised primarily a negative trade balance and a net income from oil concession transactions. Conscious and deliberate economic development was begun in the 1920's and was accompanied by a no-foreign-loan policy and a system of state controls. The latter has continued with variations up to the present, while the official attitude toward foreign loans changed definitely after World War II. From the first, development rested on oil revenues, and these were a constant source of friction with the Anglo-Iranian Oil Company. Nationalization of the oil industry resulted in a total cessation of oil income. Although foreign trade came into near balance, this was at the expense of imports and an increase in state controls. Economic stagnation was mitigated by United States assistance, and agreement with an international oil consortium finally restored Iran's international credit position.

The author concludes that economic development at an

acceptable rate is feasible only on the basis of a deficit on the foreign trade account. The deficit may be compensated by loans or grants, but the existence of a source of income such as oil revenues is ideal since it reduces the need to incur indebtedness or to become too dependent on the good graces of another country. In addition, it makes a country creditworthy for desirable projects not, themselves, bankable. Development of underdeveloped countries under present-day conditions is seen to involve the imposition of controls, and the influence of the government upon the private sector of the economy is further enhanced by disbursement of large sums of money derived from oil revenues and foreign loans and grants. The author does not attempt to assess the political measures required by this situation, but makes suggestions on the economic side for the use of such funds in a manner least likely to interfere with the growth of a private economic sector.

244 pages. \$3.15. Mic 57-2542

THE ST. LAWRENCE SEAWAY AND POWER PROJECT: A CASE STUDY IN PRESIDENTIAL LEADERSHIP (VOLUMES I AND II)

(Publication No. 21,427)

Rudolph Swayne Comstock, Jr., Ph.D.
The Ohio State University, 1956

For over a century the St. Lawrence Project has been the subject of bitter controversy in both the United States and Canada. Six American Presidents have taken a prominent and vital part in this lengthy controversy. Between the years 1922 and 1954, Presidents Harding, Coolidge, Hoover, Roosevelt, Truman, and Eisenhower entered strongly into the debate by lending their complete and active support to this great international undertaking. It is the purpose of the study to unfold the role which each of these six Presidents has played to bring the St. Lawrence Project to reality.

The approach to the problem is chronological, and each President's role in the St. Lawrence Project is considered in turn, with primary emphasis on (1) the methods which each President employed to bring about the negotiation of an international agreement with Canada and (2) the means each used in urging construction of the project on the American Congress and the American people. During the course of the study the difficulties encountered by each President with respect to international problems with Canada and domestic difficulties within the United States in regard to the project are discussed and analyzed. An incidental evaluation of Canadian views on the St. Lawrence Project through the years under consideration is also presented.

Source material is derived primarily from official documents of the Canadian and American governments, the provinces of Ontario and Quebec, and the state of New York. The six American Presidents listed have all been instrumental in leading the way to construction of the St. Lawrence Project. Had it not been for the efforts of the American Chief Executives, there would have been neither a St. Lawrence Treaty of 1932 nor an Executive Agreement of 1941. It is extremely doubtful that the St. Lawrence Project would have been brought to a successful

conclusion had it not been for the impetus provided by continuous White House support for over thirty-two years.

The six American Presidents previously listed have been highly supported, on the one hand, and vigorously criticized, on the other, for their advocacy of the St. Lawrence Project. Their unwavering support, however, has resulted, at long last, in the realization of this century-old dream. To them and to their united devotion to the project must go a very substantial proportion of the credit for bringing this vast undertaking to reality.

536 pages. \$6.80. Mic 57-2543

AN ANALYSIS OF THE DEVELOPMENT OF THE INTERNATIONAL RELATIONS OF INDONESIA

(Publication No. 21,404)

Robert W. Harper, Ph.D.
The American University, 1957

In his work, An Analysis of the Development of the International Relations of Indonesia, the writer was confronted with the problem of the new nation seeking to justify and sustain itself in the disturbed post World War II era. In addition to the Allied Powers' dilemma of whether to support Dutch claims for a return of Indonesia to the role of Dutch colony or to extend the concepts of the United Nations to the newly proclaimed Indonesian nation, there were the particular Indonesian problems of transition from a colonial to a national government, economy

and educational system. Inherent in the above was the serious deficiency of trained personnel in all fields of public life, especially so in both domestic and foreign politics.

An analytical and comparative examination of the past was presented so that the reader might better understand the background of Indonesian history, the development of the Nationalist movement and the struggle for independence. All of the above factors influenced Indonesian attitudes towards the world community and stabilized the international relations of Indonesia during the critical "cold-war" period when the young nation was attempting to find its way as a fledgling member of the United Nations.

The results of the author's work should give the reader a fresh approach to the study of Indonesia because this new country has too often been unduly castigated and misunderstood by Western writers and politicians. It is most important for a dissertation of this type to be as free of subjective Western orientation as possible, lest the reader fall into the stereotyped thinking of the centuries that prevents a clear understanding of the oriental mind, emotions, needs and drives.

The conclusions to be drawn are manifold; however, the work has been an attempt to show conclusively that Indonesia now exists as a meaningful entity in the community of nations and that the Indonesian nation might be said to be resting on a fairly firm foundation, even though the completed structure of the government and economy may not be a finished product for several generations. Above all, no hasty judgment should be pronounced in the West because of the natural "growing-pains" that do exhibit themselves in domestic Indonesian affairs and on the international level. 254 pages. \$3.30. Mic 57-2544

PSYCHOLOGY

PSYCHOLOGY, GENERAL

THE DEVELOPMENT AND VALIDATION OF A MECHANICAL PERFORMANCE TEST

(Publication No. 21,272)

Robert Lee Brown, Ph.D.
Purdue University, 1957

Major Professor: E. J. McCormick

The selection of individuals for jobs which require some type of mechanical performance is of material importance. Experience has shown that effective selection can be facilitated by use of systematic aids such as tests. The purpose of this project was to develop a new and usable test, of the performance variety, for use in the selection of individuals for some of those jobs requiring mechanical performance.

Although there are a few contemporary tests of the assembly or performance variety, certain inadequacies are inherent in them. With these problems clearly in view, and

in consideration of other principles and ideals of measurement, fourteen specific objectives were set up for the development of a new test. All of these objectives were met with some degree of success in the development and validation of the Mechanical Performance Test.

The Mechanical Performance Test consists of four sub-tests: Peg Boards; Hub Assemblies; Spatial Relations; and Gadget Assemblies. The test gives a profile of scores, rather than a single score, which permits prediction of a greater range of criteria by use of multiple correlation. The items are all new and unfamiliar, and are designed so as to keep administrative difficulties and costs at a practical minimum. The average testing time per subject has been found to be approximately 25 minutes. Time is used as the basis for a scoring system which has been simplified by the development of a Record Sheet on which the raw time scores are easily converted to stanine scores for each of the items.

Estimates of the reliability for the total test range from .88 to .93. The reliabilities of the sub-tests have been estimated to range from .67 to .87 by use of the Kuder-Richardson formula and by the average item intercorrelation technique.

Seven different concurrent validity studies were made on groups including: loom fixers; warp and smash hands; auto mechanics; auto mechanic shop students; machine shop students; and drafting students. The ranges of coefficients for the various sub-tests and the criteria for the groups tested were found to be as follows: Peg Boards, .26 to .89; Hub Assemblies, .23 to .81; Spatial Relations, .07 to .82; and Gadget Assemblies, -.14 to .63. In every case one or more of the sub-tests correlated significantly with the criterion. The median validity coefficients for the four sub-tests were: .60; .55; .41; and .45, respectively. Multiple correlations with properly weighted sub-test scores probably would yield somewhat higher validity scores. From these results it appears that performance on some of the sub-tests is related to performance on some jobs and shop courses. Although the groups were of such a size that cross-validation was not possible, the results are significant enough to suggest possible predictive validity in some situations.

107 pages. \$2.00. Mic 57-2545

DEVELOPMENT OF THE PURDUE ORAL CLASSIFICATION TEST IN SPANISH

(Publication No. 21,275)

Stanley Deutsch, Ph.D.
Purdue University, 1957

Major Professor: C. H. Lawshe

The need for a classification test in Spanish was outlined by persons in industrial, educational, governmental, and military organizations. In order to make this test usable for literate and illiterate groups alike, the test instructions were presented orally by means of plastic records or tape recording. The subjects were required to respond only by making dots, lines, or circles in the appropriate places in a specially prepared answer booklet.

An original sample of nine sub-tests containing 100 items was developed using many of the major factor analytic studies in this area as guides. Particular attention was paid to the use of items applicable to a test of this nature.

Forms 1 and 2 of the Purdue Oral Classification Test in Spanish included the following sub-tests: 1) Counting, 2) Directions, 3) Arithmetic Reasoning, 4) Simple Reasoning, 5) Deductive Reasoning, 6) Spatial Orientation, 7) Spatial Orientation, 8) Form Perception, 9) Space Perception.

Form 1 was administered to a small group of adult Mexican subjects. Certain modifications were made on the basis of experience with this group, resulting in Form 2. The second form was administered to a second small group of Mexican subjects. Administration time for each form was 60 minutes.

Data gathered as a result of the administrations of Forms 1 and 2 were used for test and item analysis. The results of this analysis determined the content of Form 3.

The Purdue Oral Classification Test in Spanish, Form 3 contained 54 of the items in Form 2, in six sub-tests. These sub-tests were 1) Counting, 2) Simple Reasoning, 3) Directions, 4) Spatial Orientation, Feet, 5) Spatial

Orientation, Hands, 6) Form Perception. Total administration time for this form was 30 minutes.

Form 3 was administered to a sample of 305 Mexican subjects with varied age, educational, and occupational backgrounds. Test reliability was estimated to be .94. The test successfully differentiated between unskilled, semi-skilled, and skilled occupational levels as defined by the U.S. Department of Labor Dictionary of Occupational Titles.

The Final Form of the Purdue Oral Classification Test in Spanish, based on the data for Form 3, contained 45 items in five sub-tests; Spatial Orientation, Hands was eliminated. Administration time was 27 minutes.

The reliability of the final form was estimated to be .93. Correlation of this form with Navy General Classification Test scores for a sample of 121 Puerto Rican recruits was .85 after correction for curtailment.

229 pages. \$3.00. Mic 57-2546

THE RELATIONSHIP OF MANIFEST ANXIETY, WAYS OF HANDLING ANXIETY, TASK DIFFICULTY, AND TASK EVALUATION TO PERFORMANCE ON AN INTELLECTUAL TASK

(Publication No. 21,058)

Norman Graff, Ph.D.
Michigan State University, 1955

The major problem of this study was to examine the effects of varying levels of manifest anxiety upon intellectual performance. Particular emphasis was placed on the subjects' method of dealing with anxiety.

Eighty subjects, forty High Anxious and forty Low Anxious, were asked to solve two sets of twelve anagrams (subdivided into three difficulty levels with four anagrams at each level). Immediately following completion of a set, each subject evaluated his work and compared it with his subjective assessment of the other subjects' work. After the first set, the investigator systematically gave either a positive or a negative evaluation of the subject's performance.

The differences in performance between High and Low Anxious groups, at each of the difficulty levels, were not statistically significant. However, the direction of each difference was in accord with the theoretical formulation as to interplay between task-relevant and task-irrelevant responses at different intensities of anxiety. As expected, neither the High nor the Low Anxious group was consistently superior at all anagram difficulty levels. The Low group was superior at the easiest and at the most difficult level, and the High group was superior at the intermediate difficulty level.

The interaction between investigator's evaluation and anxiety level was significant. Negative evaluation (frustration) tended to improve performance of the High Anxious when the task was more difficult, while examiner "approval" tended to elicit poorer performance. Comparable examiner evaluations of Low Anxious groups yielded a contrasting picture (beyond the easy anagram level). Negative evaluation was followed by minimal or no change, while "approval" tended to improve performance. Both negative and positive evaluations were followed by

significantly poorer performance in both groups on the easy anagrams.

A bow-type function was obtained, for the most part, between degree of manifest anxiety and grade-point average ($N = 173$). Only female members of the lowest anxiety group deviated from this pattern, since they achieved the highest grade-point average of any sub-group. Aside from this single discrepancy, an intermediate level of anxiety resulted in the best academic performance.

It was found that variations in the anxiety index proved insufficient to account for performance differences on both grade-point average and anagram rigidity. The habit pattern, characteristic of each subject's method of handling anxiety, appeared to be important in determining his generalized intellectual efficiency. The characteristic ways of handling anxiety were inferred from the M.M.P.I.--combinations of peak-scores or the Welsh Internalization ratio. High internalization (for Anxious subjects only) was associated with greater intellectual efficiency.

The data obtained from each subject's evaluation of his performance tended to validate the notion of generalized manifest anxiety. The fact that the High Anxious tended to underestimate their achievement level and overestimated, significantly more than the Low Anxious, the amount of effort they had to expend as compared with others was considered validating evidence.

The present findings indicate that the relationship between manifest anxiety and intellectual performance is complex. Ways of handling anxiety, examiner evaluation, and task difficulty all influence this relationship.

132 pages. \$2.00. Mic 57-2547

THE RORSCHACH AS A MEASURE OF PERSONALITY CHANGE IN CHILDREN IN A RESIDENTIAL SCHOOL FOR MENTALLY HANDICAPPED

(Publication No. 21,059)

Mary Ella Hand, Ph.D.
Michigan State University, 1955

The purpose of this study is to investigate the usefulness of the Rorschach as a measure of personality change in high grade mentally handicapped children who are in residence in a publicly supported institution. Three hypotheses were formulated: (1) evaluations of personality change based on the comparison of Rorschachs are in agreement with evaluations of behavioral change based on descriptive reports for the same period of time; (2) evaluations of personality change based on Rorschach findings are in agreement with evaluations of adjustment at the termination of the experiment; (3) changes in certain Rorschach scores and combinations of scores are related to change in observed behavior.

The original group of subjects consisted of sixty consecutive admissions with an age range of 10-0 to 12-0 years. A Rorschach was administered at admission and at the end of a years residence. A third Rorschach was administered to thirty boys with an average time interval of three years nine months between the second and third tests. In order to obtain a more homogeneous group, 47 children were selected and considered separately. The Chi-square technique was used to determine the probability

of a significant relationship between Rorschach and behavioral evaluations.

The relation between the evaluations obtained from comparing Rorschachs II and III and the behavioral evaluations for the same time interval for each subject was significant at the five percent level. Relationships stated in the remaining sections of hypotheses I and II were not statistically significant. However, the probability of a significant relationship between Rorschach findings and terminal adjustment was increased when the time interval between Rorschachs was increased or when the group with a reasonable expectation of return to community was considered separately. Only one of the twelve signs tested was found to be significantly related to behavioral change.

77 pages. \$2.00. Mic 57-2548

VALIDITIES OF A PERSONAL HISTORY FORM FOR AUTOMOBILE SALESMEN IN GENERAL COMPARED WITH SUBVARIETIES OF AUTOMOBILE SALESMEN

(Publication No. 21,067)

James Edward Kennedy, Ph.D.
Michigan State University, 1956

Purpose. The purpose of this study was to compare two methods of constructing a selection instrument for use with car salesmen. One, an "Over-all Method" assumed the sample of car salesmen studied were sufficiently homogeneous to warrant treatment as a single group in the course of developing the instrument. The other, a "Subvariety Method," assumed sufficient differences among subvarieties of salesmen within the sample to warrant unique treatment of each in the course of developing the instrument.

Predictors. Two-hundred and ninety objective type items were used as trial predictors. These could be classed as: personal data or biographical, personality, attitude, or interest. The items were divided and two trial forms of the questionnaire were prepared; Form A and Form B. Those items which were found to be most promising in the item validity analyses were used to prepare Form C.

Criterion Analysis. Five measures of job performance were considered. Two were eliminated as impractical after a pilot study; three were collected for the item analysis sample. High intercorrelations among the three measures suggested little would be gained from using a composite criterion. Earnings over a standard time period was chosen as the sole criterion.

Population and Samples. The car salesmen investigated were employed in car dealerships throughout the country. Form A and Form B were administered to salesmen from Samples I and II respectively. Those questionnaires were used for the item validity analyses and for developing scoring keys. Form C was administered to Sample III for validation and cross validation. The following numbers of questionnaires were available for analysis: Form A, 358; Form B, 335; Form C, 749.

Subvarieties of Salesmen. Eight subvarieties of salesmen were originally considered. The limited size of Sample III required a revision of the design; only six

subvarieties were actually explored. An Analysis of Sub-varieties was conducted to determine which pair of sub-varieties could most defensibly be eliminated.

Item Validity Analysis. One item validity analysis was conducted for Form A items considering all Sample I salesmen as a single group; six item validity analyses were conducted considering each subvariety from Sample I as a separate group. This was repeated for Form B using Sample II. The 40 items which had been found to be most predictive from each of the seven analyses were identified. Scoring keys were developed for the items. This resulted in an Over-all Key and six different Subvariety Keys each with 40 items.

Validation and Cross Validation. Sample III was subdivided into 14 sub-samples. Seven of the samples were used for estimating the validities of the seven scoring keys; seven were used for estimating the cross validities. The relationships between the predictors and the criterion were analyzed in four ways.

Results and Conclusions. The four methods of analyses on the whole gave consistent results. No significant differences were obtained in the predictive efficiencies of the two kinds of Keys. It was concluded that the less laborious Over-all Method was as efficient as the Sub-variety Method. 98 pages. \$2.00. Mic 57-2549

A NON-PARAMETRIC TEST OF ASSOCIATION

(Publication No. 21,446)

Warner Jay Merrill, Jr., Ph.D.
The Ohio State University, 1956

A non-parametric test of association is developed, based on two dichotomies both of which are expressed by parameters of the binomial distribution $N(p + q)^n$ where the p's are .5 and n = 1. The formula for this case is

$$r_{bn1} = 1 - \frac{\sum |D|}{N/2}$$

while for the more general case where $n > 1$, the following holds true:

$$r_{xy} = 1 - \frac{\sum D^2}{2N_s^2}$$

A comparison of the former test (r_{bn1}) with Pearson r and the Ohmstead-Tukey Corner Test, based on an empirical study of 400 samples of size 10 and 400 of size 20, indicates that it is the least discriminating of the three, but faster to calculate (by hand) than any other such index by an appreciable margin. On dichotomous data it is equivalent to the Pearson r. Indications are that an extension of the concept to r_{bn2} may retain the time advantage and increase the power of the test.

The probabilities of all possible r_{bn1} 's for even sample sizes from two to forty are calculated for the development of confidence levels for the null hypothesis of no association.

Some additional ideas for research and a discussion of probabilities for other hypotheses are mentioned briefly.

29 pages. \$2.00. Mic 57-2550

THE RELIABILITY OF PEER OBSERVERS' RATINGS AS A FUNCTION OF SOME VARIABLE CHARACTERISTICS OF THE RATING SCALE

(Publication No. 21,767)

Siroon Pashalian, Ph.D.
New York University, 1957

Adviser: Thomas N. Jenkins

The purpose of the study was to investigate the effect of variations in the number of scale steps, the amounts of verbal definition, and the types of traits rated, upon both inter-rater and intra-rater reliability of peer observers' ratings of behavior.

A "master" 15-point rating scale was constructed, from which 18 different rating scales were derived, using six different numbers of scale steps--5, 7, 9, 11, 13, and 15--three amounts of verbal definition--every point defined, every other point defined, and center and end points only defined. Each scale included the four personal and four social adjustment traits selected for study: persistence, decisiveness, buoyancy, nervousness, gregariousness, talkativeness, punctuality and shyness. In each different rating scale, the two types of traits were alternated, and the order of presenting the traits, the physical distance between end points, and the definitions of extremes were kept constant.

The 18 different rating scales were assigned at random for use in a rating of peer members to 18 different volunteer college social groups. Each was comprised of a varying number of members who participated--from 8 to 16 members, with an average of 12 members. A total of 214 female undergraduates participated. After an interval of from one to four weeks, without foreknowledge of the task, from 4 to 14 members who had participated previously in each group, 157 subjects altogether, were asked to re-rate the same members using the same rating scale.

For the inter-rater reliability analysis, based upon the first ratings, group sizes were equalized to ten members in each group, by eliminating the ratings of certain members so as to match the groups for length of acquaintance. The average group acquaintance was about two years. Inter-rater reliability estimates were computed by Ebel's method, for each of two randomly subdivided groups within each group for each trait. In every group, one estimate was based on five members rating the other five members, and the other estimate was based on the latter five members rating the former five members. The resulting 288 inter-rater reliability estimates, using corresponding z score transformations in a 6x3x2 factorial design, were treated by analysis of variance. Other analyses were also performed, including one analysis of variance of the means of the two group estimates.

For the intra-rater reliability analysis, the first and second ratings of the nine other members within their groups were used for three persons chosen at random from each group. The intra-rater reliability estimates were also computed by Ebel's method. The resulting 432 reliability estimates, using corresponding z score transformations in a 6x3x2 factorial design, were treated by an analysis of variance. An alternate method of analyzing the data, utilizing the means of the three group intra-rater reliability estimates, was also performed.

By the overall method of analyzing the data, inter-rater

reliability was not affected significantly by the number of scale steps, the amounts of verbal definition, or the types of traits, nor by any interactions of these variables. By an alternate method of analyzing the data, the triple interaction proved significant.

By the overall method of analyzing the data, intra-rater reliability was affected significantly only by the number of scale steps variable. The highest reliability was obtained for the 9-point scales, with an average of .72; the lowest for the 11-point scales, with an average of .48. By the alternate method of analyzing the data, the triple interaction also proved significant.

The comprehensive design highlights the need for examining apparent reliability for sources of spuriousness, e.g., coarse refinement, raters' tendencies to use only defined points when every point is not defined.

155 pages. \$2.05. Mic 57-2551

**A STUDY ON THE SELF-CONCEPT OF FUNCTION
WITHIN THE PROFESSION OF
COUNSELING PSYCHOLOGY**

(Publication No. 21,450)

Stanley Irwin Rubin, Ph.D.
The Ohio State University, 1956

The manner in which professions develop is probably related both to social need and to the concept of function entertained by members of a professional group. In order to study the problem of professional development it is necessary to deal with one professional specialty in the hope of obtaining data that might conceivably be used to study the development of other professions. This research focused upon the profession of psychology, and specifically upon counseling psychology.

The study was an initial attempt at evaluating the functional development of Veterans Administration hospital counseling psychology services. The purpose of the research was to investigate the attitudes of Veterans Administration Counseling Psychologists (Vocational) toward their activities, in an effort to aid them to identify and clarify the functions they should perform.

A questionnaire containing 177 items descriptive of activities that a counseling psychologist might perform was mailed to all counseling psychologists and consultants who appeared on the January, 1956, Veterans Administration roster. A total of 127 subjects received questionnaires, of which 92 were usable for the study. The 92 subjects were composed of 35 chief counseling psychologists, 20 counselors, and 37 consultants. Every subject was asked to rate each of the questionnaire items on a five-point rating scale designed to indicate the priority to be given each of the activities mentioned. Chiefs and counselors were asked to give two ratings to each item: one indicating the priority given the activities they were then performing, and another indicating the priority to be given activities they believed a counseling psychologist should perform. Consultants were asked to give only the latter rating.

For each item, the responses made by one group were compared with those made by the other two groups. In addition, comparisons were made within and between

groups. Measures of central tendency and dispersion were calculated for each group's ratings and were subjected to an item analysis. For each of the statistical comparisons made, the highest quartile of statistically significant items was assigned to one of seven a priori categories descriptive of the activities mentioned in the questionnaire items.

The results of the study showed that (1) chiefs and counselors both believed that they should be doing more research; (2) there were no significant differences between the should ratings made by chiefs of a service and those made by counselors; (3) consultants differed significantly from both the chiefs and the counselors on the should ratings, especially over public relations activities; (4) on the should ratings high intragroup variance was found within all three groups concerning evaluation and formulation, counseling, and administration and consultation activities; (5) chiefs, counselors, and consultants tended to agree upon the level at which a counseling psychologist should function in his role as a counselor trainer.

On the basis of the results obtained in the study, the following general conclusions were reached: (1) chiefs and counselors share similar concepts of the functions a counseling psychologist should perform, but neither group shares similar concepts with the consultants, except when the training of graduate students is involved; (2) there are significant differences between present functions performed by chiefs and counselors and those that they feel they should be performing; (3) the extent of commonality in the concept of function entertained by chiefs, counselors, and consultants seems to be related to the degree to which these groups share similar professional experiences.

200 pages. \$2.60. Mic 57-2552

**ACHIEVEMENT MOTIVATION BEFORE AND AFTER
FRUSTRATION AND ITS RELATION TO MANIFEST
ANXIETY IN SCHIZOPHRENIC PATIENTS**

(Publication No. 21,125)

Albert Ronald Rustebakke, Ph.D.
Columbia University, 1957

Chairman: Edward J. Shoben, Jr.

The major purpose of the present experiment was to investigate the relationship with schizophrenic patients between manifest anxiety and projective measures of achievement motivation (NACH). Specifically, four hypotheses were tested:

1. There is a positive relationship between manifest anxiety and achievement motivation in "relaxed" situations.
2. There is a positive relationship between manifest anxiety and achievement motivation following a situation designed to arouse and then to frustrate a need to achieve.
3. The achievement motivation of schizophrenic patients increases as a result of attempts to arouse and then to frustrate a need to achieve.
4. There is a positive relationship between manifest anxiety and increase in achievement motivation following arousal and frustration of a need to achieve.

Two groups were used in the study: Group I, which furnished a major portion of the data relevant to the

hypotheses, and Group II, a control group of patients used to determine whether familiarity with the procedure for collecting NACH stories and with E might influence the effects of frustration on the measure of achievement motivation. The Taylor Scale of Manifest Anxiety was the first test administered to both groups. With Group I, three measures of achievement motivation were obtained at two-week intervals from each subject. The first two were taken under "relaxed" conditions, and from these a coefficient demonstrating satisfactory test-retest stability of the NACH measure was obtained. The third measure of NACH for Group I was taken immediately following a situation designed to arouse and then frustrate a need to achieve. For Group II, the single measure of NACH was taken under "aroused and frustrating" conditions.

Both objective scoring using McClelland's system¹ and rankings of NACH from the four-story protocols were used in testing the hypotheses. A relatively high relationship between the two methods indicated that both measured essentially the same variable reliably.

Complete data were obtained from 38 subjects for each group. The data failed to support any of the hypotheses and no statistically significant alternative trends were discovered. In all cases, the null hypothesis was accepted. These results were discussed in terms of their implications for interpretation of Taylor scale scores, and for the personality and behavioral characteristics of schizophrenic patients. 56 pages. \$2.00. Mic 57-2553

1. D. C. McClelland, J. W. Atkinson, R. A. Clark, & E. L. Lowell. The achievement motive. New York: Appleton-Century-Crofts, 1953.

Criterion variables used included: (a) number of facts exchanged during the interview, (b) number of opinions or expressions of feeling offered by interviewer and interviewee, and (c) ratings of the interview by raters who listened to the recordings and were instructed to identify with the interviewee in making their ratings of the interview.

Non-parametric phi coefficients were used to test the significance of the relationships between the behavior variables and the criterion measures of the interview. The direction of the relationships was noted to see whether they supported or failed to support various hypotheses as to the expected relationships.

Obtained relationships were generally low with a scattered minority of coefficients significant at .10 to .01 levels of confidence. One encouraging aspect of the results was the consistent direction of the results even where individual coefficients were not significant. Results are viewed as suggestive rather than conclusive due to the low order of obtained relationships.

Based on results of the study, a "good" interview is indicated to be one with the following characteristics: (a) a free and productive exchange of both facts and opinions between interviewer and interviewee, (b) interviewee talking proportionately more than is usual, (c) a permissive and non-threatening atmosphere provided by the interviewer, (d) few pauses (but, pauses may be used by the interviewer to obtain more information from the interviewee), and (e) many mutual interruptions, creating an atmosphere of mutual involvement and participation.

Conversely, the "poor" interview is typified by interviewer or interviewee domination and a threatening atmosphere in which few interruptions and frequent long pauses occur. It is a poorly paced, overcontrolled type of power-centered situation. 143 pages. \$2.00. Mic 57-2554

CONVERSATIONAL BEHAVIORS AND THEIR EFFECTS IN THE INTERVIEW

(Publication No. 21,412)

Douglas Ross Talcott, Ph.D.
University of Houston, 1957

This study explored the relationships between certain conversational behavior variables and certain criteria of interviewing effectiveness. The interviews studied consisted of thirty-two mock employment interviews done by representatives from business and industry in an interviewer training situation. Interviewees were volunteer university students, strangers to the interviewers. An element of realism was provided since the students were often seniors who wished to be considered for employment, and most of the interviewers could be instrumental in arranging employment in their companies.

All interviews were recorded and verbatim typescripts were made for use in this study.

Conversational behavior variables studied included: (a) the relative amounts of time talked by the interviewer and the interviewee, (b) the use of personal pronominal references by the interviewer, (c) the use or occurrence of pauses in the interview conversation, (d) the extent to which the interviewer and interviewee interrupted each other during the conversation, and (e) the amount of time and number of instances during which the interviewer and interviewee were talking simultaneously.

A COMPARATIVE STUDY OF NEGRO AND WHITE COLLEGE STUDENTS' AGGRESSIVENESS BY MEANS OF SENTENCE COMPLETION

(Publication No. 21,317)

Frank Virgil Touchstone, Ph.D.
Purdue University, 1957

Major Professor: H. H. Remmers

The study is introduced as one which investigates Negro reaction to discrimination and its relation to corresponding white group behavior. Frustration, aggression, hostility, passivity, withdrawal, and discrimination are defined. Special attention is directed to the distinction made between aggression as overt and hostility as covert.

Ten assumptions dealing with frustration, aggression, hostility, and discrimination are made. The problem is stated: Does the additional frustration of discrimination elicit additional overt and covert reaction among Negroes? Hypotheses are:

1. The Negro group will reveal, overall, significantly more aggression than the white group.
2. The Negro group will reveal, overall, significantly more hostile feeling than the white group.

3. The Negro group will reveal, overall, significantly more passive behavior than the white group.

4. The Negro group will reveal, overall, significantly more withdrawal behavior than the white group. Sex and socio-economic status as related to the behavior are also to be studied.

The literature about response to frustration is followed by literature on Negro response to discrimination, by that dealing with social class factors related to frustration, and then deals with recent pertinent studies.

Aggression, hostility, passivity, and withdrawal were measured by a sentence completion test composed of stem items selected to maximize elicitation of the behaviors. The test was administered to freshmen at two Negro and two white colleges in the western part of the South. After administration, trained judges working individually, separately rated each item on each completed test for the presence of the behavior. During pilot judging the additional score of perceived aggression developed. Five scores were computed from the items on which an established level of inter-judge agreement was reached. Individuals were grouped according to ethnic group, sex, and socio-economic status and the hypotheses tested by a between cells analysis of variance and individual comparisons on appropriately grouped cells. Withdrawal scores were studied by chi square analysis. Correlations between various scores were computed.

Data were pooled for the analyses of scores except perceived aggression, when the colleges of like ethnic group were not found to be different. Separate analyses of perceived aggression scores suggested that a difference found between the two white colleges could be traced to greater concern over war, and this apparently contributed to near significance in the larger analysis.

The stated hypotheses were all rejected since differences between ethnic groups were found to be non-significant. Sex differences were not found, although there was a tendency for aggression scores of white females to be lower and for their passivity scores to be higher than the other three ethnic-sex groups. Differences based on socio-economic status were found only in the case of passivity scores the lower groups had less. Chi square analyses of withdrawal scores revealed no significant differences at the 5% level, though a higher incidence in Negroes is shown by a difference significant at the 9% level. Correlations were not high enough for prediction or meaningful discussion.

The failure to obtain predicted differences is discussed at some length, relating it to the literature surveyed, and considering possible explanations. Additional findings related to the predictions are reported.

Of the possible explanations of failure to find predicted differences, the one that Negroes do not experience discrimination as frustration is somewhat contradicted by the finding that Negroes are more concerned about segregation and equality than are whites. This and the suggested repression of aggression and hostility by the middle class subjects, can be tested in a study using northern and southern groups and testing whether the difference between northern ethnic groups is greater than that between southern ethnic groups, due to less need for control of aggression by the northern Negroes.

112 pages. \$2.00. Mic 57-2555

PSYCHOLOGY, CLINICAL

CHLORPROMAZINE IN THE TREATMENT OF CHRONIC SCHIZOPHRENIA: A COMPARATIVE INVESTIGATION OF THE THERAPEUTIC VALUE OF CHLORPROMAZINE IN EFFECTING CERTAIN PSYCHOLOGICAL AND BEHAVIORAL CHANGES IN CHRONIC SCHIZOPHRENIC PATIENTS

(Publication No. 21,692)

Julian Abrams, Ph.D.
New York University, 1957

The purpose of the investigation was to determine the therapeutic effectiveness of chlorpromazine as a method of treatment of chronic schizophrenia. Intellectual functioning, the presence of anxiety and hostility, and overt behavioral patterns were evaluated, pre- and post-treatment, for a chlorpromazine group and a placebo group separately, and comparisons were made between the groups.

The population consisted of chronic, female, hospitalized schizophrenics between the ages of 20 and 55 who had been hospitalized for a consecutive minimum period of two years, and who had not profited from other therapies. Forty patients were selected and divided, at random, into two groups, one group receiving chlorpromazine, the other group a placebo. During the course of the investigation, two patients were eliminated from the chlorpromazine group and four patients from the placebo group for various reasons. There were no significant differences between the groups in respect to age and length of hospitalization at the beginning of treatment.

The chlorpromazine group received between 400 and 600 milligrams of the drug per day; the placebo group received 400 milligrams of placebo daily. Certain clinical and laboratory procedures were followed for both groups as a precaution against harmful side reactions which frequently accompany chlorpromazine treatment. Each group was in treatment for a total period of four months.

Prior to the onset of treatment, each patient was administered the Wechsler-Bellevue Intelligence Scale, Form I, and the Rorschach Test, and the Multidimensional Scale for Rating Psychiatric Patients was completed by the psychiatrist in charge of the chronic female service and the nurse or ward attendant most familiar with the patient. The same procedure was repeated upon completion of treatment four months later.

The Wechsler-Bellevue was evaluated for intellectual functioning using the Full Scale I.Q., the Verbal I.Q., the Performance I.Q., the weighted scores for each of the 11 subtests, and the raw scores for the Digits Forward and Digits Backward parts of the Digit Span subtest. The Rorschach was scored for anxiety and hostility utilizing Elizur's method of content analysis for these systems of tension. The MSRPP was evaluated for overt behavior by means of the total Morbidity score and the scores for each of the 11 factors descriptive of varying behavioral patterns.

Analysis of the mean data for the chlorpromazine group alone showed significant improvement in overall intellectual functioning, improved logical thinking, a reduction in anxiety and hostility, a decrease in overall severity of symptoms, and changes in eight of the 11 factors descriptive of overt behavior. The placebo group, when evaluated separately, showed significant improvement in overall

intellectual functioning and improved concentration and attention. There were no other significant changes after treatment.

When comparisons were made between the groups, the chlorpromazine group showed significant improvement in logical thinking, a decrease in overall severity of symptoms, less perceptual distortion, a decrease in motor disturbances, less hostility and a greater tendency toward submissiveness, and less conceptual disorganization. The placebo group, on the other hand, was significantly more withdrawn upon completion of treatment.

Due to the small samples involved and the restrictions of the experimental design, the conclusions must be considered tentative. The following conclusions are delimited to the chronic, female, hospitalized schizophrenics previously described:

1. Chlorpromazine is an effective therapeutic agent insofar as it enhances logical thinking, reduces the severity of symptomatology, and brings about improved patterns of overt behavior.
2. Chlorpromazine treatment has the effect of initiating a reversal of the schizophrenic process by penetrating the psychotic disorganization and reorganization but it has little influence on the withdrawn attitude of the patient.
3. Chlorpromazine can produce greater inactivity and submissiveness so that the patient passively accepts the medication as treatment without active participation on his part, indicating a need for supplementary rehabilitative procedures.
4. Chlorpromazine was not significantly more effective than a placebo in improving overall intellectual functioning, or in reducing the amount of anxiety and hostility present in the patient.
5. The use of a control (placebo) group for comparison purposes, and the use of psychological tests and scales instead of reliance on clinical assessments of overt behavior tend to make for more objective, valid evaluations of chlorpromazine treatment.

144 pages. \$2.00. Mic 57-2556

A PRELIMINARY EXPLORATORY STUDY OF AUTHORITARIANISM AS MANIFESTED IN THE FORMAL EDUCATION OF CHILDREN

(Publication No. 21,693)

Robert F. Allen, Ph.D.
New York University, 1956

The Problem

Certain attitudes of teachers toward children and school work have been found to be predictive of the quality of classroom atmosphere maintained by them in school situations. The purpose of the present investigation is to determine to what extent, if any, these attitudes are significantly correlated with authoritarian trends in the teachers' personalities.

The Population

The study population consisted of 1,012 elementary

school teachers and prospective teachers all of whom were either employed in the public schools of New York State or were in their final year of professional preparation for teaching in New York State teacher training institutions. They were quite evenly distributed in terms of geographical location with approximately one third of the subjects being tested in institutions located in rural upstate areas, one third in institutions located in suburban areas immediately outside of metropolitan New York City and one third in large cities having populations of 100,000 people or more. Somewhat the same subdivision applied in terms of the nature of the participating units, with approximately one third of the subjects being tested in undergraduate institutions, one third in graduate institutions, and one third in New York State public elementary schools.

Procedures

Two basic instruments were selected for administration to the study population. The first of these was the Frenkel-Brunswik F Scale which had been found through prior research to be a valid and reliable instrument for the measurement of authoritarian personality trends. The second instrument utilized was the Minnesota Teacher Attitude Inventory which had been found through prior research to be a valid and reliable instrument for the measurement of those attitudes of teachers toward children and school work that have been found to be predictive of the quality of classroom atmosphere maintained by them in school situations. The data gained through the administration of these instruments was supplemented by data secured through personal interviews which were conducted with forty subjects selected from those teachers scoring at the extremes of both scales.

Conclusions

It was found that subjects possessing a high degree of authoritarian personality trends were quite likely to have markedly different attitudes toward children and school work than were subjects possessing a lesser degree of such trends. It was also noted through an analysis of the predictive nature of these attitudes that non-authoritarian teachers in this study population were much more likely to maintain a stable, harmonious and productive atmosphere in their respective classrooms than were their more authoritarian counterparts. The nature of these attitudinal differences between authoritarian and non-authoritarian teachers further suggested that authoritarian personality trends might well play an important role in the educational process, and the conclusion reached was that authoritarian personality factors could not be overlooked if sound educational programs were to be developed and maintained.

211 pages. \$2.75. Mic 57-2557

SELF-DISTORTION AND DISTORTION OF OTHERS

(Publication No. 21,599)

Leonard Aronson, Ph.D.
Columbia University, 1957

Chairman: Joel R. Davitz

This study investigated certain relationships between self-distortion, distortion of others, sociometric choice and social adjustment. Three groups of subjects were

used, consisting of 15 senior men at Yeshiva College, 12 sophomore women at Stern College, and 12 freshmen women at Stern College. The subjects rated themselves and the others in their group on twelve bipolar personality traits, each trait ranging along an eight-step graphic rating scale. They also indicated whom they liked and disliked in their group. Distortion was defined in terms of discrepancy between consensual ratings and individual ratings. Social adjustment was defined in terms of the mean consensual rating received by a subject on all twelve traits.

The following hypotheses were confirmed:

1. Sociometrically disliked others are perceived with greater distortion than sociometrically neutral others.
2. Sociometrically disliked others are perceived with greater distortion than sociometrically liked others.
3. Distortion of sociometrically liked others is in a more positive direction than distortion of sociometrically neutral others.
4. Distortion of sociometrically disliked others is in a more negative direction than distortion of sociometrically neutral others.
5. The negative distortion of sociometrically disliked others is greater than the positive distortion of sociometrically liked others.
6. Amount of self-distortion is positively related to amount of distortion of others.
7. Low self-distortion is positively related to good social adjustment.

The following hypotheses were not confirmed:

1. Sociometrically liked others are perceived with greater distortion than sociometrically neutral others.
2. An individual's highly self-distorted traits are associated with a greater amount of distortion of others than are his less self-distorted traits.

46 pages. \$2.00. Mic 57-2558

THE PERCEPTION OF SEXUAL SYMBOLISM

(Publication No. 21,627)

Elizabeth Dunning Barker, Ph.D.
Columbia University, 1957

Chairman: Laurance F. Shaffer

The present experiment was concerned with the Freudian hypothesis that certain objects have an inherent sexual symbolic meaning on the basis of their form. An alternative hypothesis relating cultural meaning, rather than form, to sexual symbolic significance was also included.

The experimental materials consisted of forty cards, each containing a line drawing of an object. Thirty cards pictured objects categorized by Freud as sexual symbols. Judges assigned ten of these objects to the category of low cultural sexual significance, and twenty objects to the category of high cultural sexual significance. The remaining ten cards consisted of objects not categorized by Freud as sexual symbols, and with low cultural sexual significance.

For the experiment sixty children were divided into three groups of "pre-latency," "latency," and "post-latency" ages. All subjects received an initial test followed by a retest one month later. Each subject was seen individually.

Four- and five-year-old subjects were presented with each card and asked, "Does it seem more like a boy or a girl, a mommy or a daddy." Older subjects were told that the cards represented characters for a children's story. They were asked to help the author select the characters by telling, for each card, if it "seems more like a boy or a girl, a mother or a father."

The subjects' responses to these symbols were used to test the Freudian hypothesis that the symbols would be perceived as male and female in terms of their form designation. The results of the experiment failed to confirm this hypothesis. The data show that without the variable of cultural meaning, the rating of symbols in agreement with their Freudian designation does not differ significantly from chance ($p = .50$).

An additional hypothesis, derived from Freud's theoretical formulation, predicts that the ability to rate symbols (in agreement with Freudian designation) will be high for pre- and post-latency age groups, and low for the latency age groups. The data fail to confirm the prediction. Age groups differ only in respect to four- and five-year-old children's lower ability to rate sexual symbols with high cultural meaning. When the variable of cultural meaning is not present there is no significant difference between children of pre-latency, latency, and post-latency age.

These results were seen as suggesting that interpretations of behavior based upon the assumption of a universal relationship between form and symbolic meaning are open to serious question. The data were further interpreted as indicating that cultural meaning is a relevant determinant of children's perception of sexual symbolism.

39 pages. \$2.00. Mic 57-2559

SOME RELATIONSHIPS BETWEEN FANTASY AND SELF-REPORT BEHAVIOR

(Publication No. 21,602)

Roy Cuno Calogeras, Ph.D.
Columbia University, 1957

Chairman: Goodwin Watson

The present study constituted an attempt to compare systematically certain dimensions of intra-family attitudes on the level of fantasy, as measured by the Thematic Apperception Test (TAT), and self-report behavior, as measured by direct, indirect and interview data-collection techniques. The point of view was taken that the lack of systematic uniformities relating to the findings in the fantasy-overt behavior relationship could best be explored through a network of correlations among the different techniques.

Fifty-seven (57) high school boys (10th graders) of average to superior intelligence, ranging in age from 14 years 1 month to 15 years 8 months were studied. No assumptions were made as to the representativeness of the sample as regards the general high school population of students. The procedure followed in administering the different data-collection techniques was divided into three phases: the TAT was administered in groups of from 5 to 10 Ss using slightly modified standard instructions; the direct and indirect attitude questionnaires were given at

one sitting; the interview was conducted on an individual basis oriented around 11 general questions dealing with intra-family problems and situations. In quantifying and comparing the data, basic reliance was placed on certain selected correlational methods as the most efficient means of exploring the different relationships. Two principal correlation models were used, the point-biserial model for the comparison of the TAT response variables with the other data-gathering procedures, and the tetrachoric model among the direct, indirect questionnaires, and the interview.

The general hypothesis tested in this study was accepted. That is to say, a significant as well as a direct relationship appears to exist between TAT derived intra-family attitudes and comparable attitudes measured by the self-report techniques. A more complex relationship was found between: (1) the degree of relationship occurring between the TAT and the different self-report techniques, and (2) the degree of relationship among the self-report techniques. In addition, interesting and pertinent adjunctive correlation increases occurred, between the TAT and the different self-report measures, when Authority-Subject responses on the TAT were combined with their corresponding Parent-Subject responses. As a whole, the majority of the significant correlations obtained were undoubtedly too low to be of value in individual prediction, although their value in indicating group prediction and trend relationships for this type of data was clearly indicated.

In sum, the choice of approach was essentially social psychological in conceptual focus, and quantitative in scoring and analysis. The results and conclusions were discussed in relation to their limitations and implications. The implications were viewed mainly from the theoretical standpoint and integrated with past research and personality and projective theory. In general, perhaps the main contribution of this experiment lies, not in the consistency and significance of the results, but in the implications (and limitations) it offers subsequent research: (1) in terms of the efficacy of an interpersonal and social analysis of fantasy data; (2) as a guide pointing to the conditions under which inferences based on fantasy directly relate to overt aspects of behavior as well as the conditions or controls for other types of relationships; and (3) in the suggestions and hypotheses made for further research.

190 pages. \$2.50. Mic 57-2560

THE EFFECT OF ORAL NEED ON COGNITIVE RESPONSES OF CHILDREN

(Publication No. 21,588)

Haskel Cohen, Ph.D.
Boston University Graduate School, 1957

Major Professor: A. William Hire

The purpose of this study was to investigate certain effects of oral need on perception and cognition. The general hypothesis was that oral need affects perception and cognition in individuals in relation to stimuli with which they are confronted in such a way as to accentuate any oral-related aspects of the stimulus situation.

Oral need was inferred to be of high or normal intensity from body weight. Previous studies in the area of oral need dealt with this need by experimentally inducing its presence through food deprivation procedures. The present research intentionally took into account differences in need intensity, as this was reflected in a group of obese children.

Theories of obesity have generally agreed that causation is associated with the fact that the obese person persistently eats more than his body needs for its normal growth and repair functions. Presently, there is no known adequate physiological mechanism or disturbance that can account for either the obesity or the overeating. When the general hypothesis was applied to obese children, the specific hypothesis that followed was that obese children will accentuate or facilitate perceptually and cognitively the oral aspects of the stimulus situation.

The experimental subjects consisted of thirty obese children for each of whom a comparable match with regard to age, classroom experience, grade progress, intelligence, and sex had been found. Time of day for testing was controlled.

To test the general and specific hypotheses, four dependent variables were studied. Three tests were used to investigate these variables. One, involving serial learning of relatively simple words appropriate in length to the age group of six to twelve, provided the data for the proportion of oral errors to neutral errors in learning (Index of Oral Errors), and the comparative speed in the learning of oral words. A modified Rorschach test, in which the subjects were asked to discriminate on forty pairs of items, served as a perceptual choice task. Each pair of items consisted of an oral and a non-oral percept, and the subjects had to choose the one which in their estimation most resembled a given blot area. Each pair of items previously had been judged by psychologists to contain an oral percept. A word association test was used to study the fourth dependent variable, but no prediction for it was ventured at the beginning of the experiment. This test consisted of fifteen ambiguous oral words for which the subjects had to give three associations.

The following predictions were made:

- 1) The obese group will have a larger Index of Oral Errors, (oral errors/oral + neutral errors) than the normal group when presented with the same list of oral and neutral words to learn.
- 2) The obese group will require fewer trials in learning the oral words than the neutral words in a list of oral and neutral words compared with the normal group.
- 3) The obese group will choose the oral percept of an oral and non-oral percept choice in an ambiguous stimulus situation more frequently than the normal group.

The results of the experiment supported the first and third predictions. The variable of the kind of word associations showed a tendency for obese children to give more oral associations than normal children. The results of the test of the speed of learning predictions were not consistent with the other experimental findings.

The experimental findings lend further support to the general hypothesis that oral need affects perception and cognition in such a way as to facilitate the oral-related aspect of the stimulus situation.

108 pages. \$2.00. Mic 57-2561

TEST ANXIETY, SELF-ACCEPTANCE,
AND TASK PERFORMANCE IN
AN INDUCED FAILURE SITUATION

(Publication No. 21,632)

Louis David Costa, Ph.D.
Columbia University, 1957

Chairman: Joel R. Davitz

Several hypotheses relating to the performance of a task, and change in self-acceptance, after induced failure on the task were studied in the present experiment. Task performance and change in self-acceptance were related to the personality variables of test anxiety, initial self-acceptance, and extraversion-introversion.

Test anxiety was measured by the Mandler and Sarason Questionnaire on Attitudes Toward Three Kinds of Testing Situations, self-acceptance by scores on the self-acceptance scale of the Index of Adjustment and Values, and extraversion-introversion by the Thoughtfulness scale of the Guilford-Zimmerman Temperament Survey.

Students at The City College, New York were pretested with the personality measures. Group norms were developed for the test anxiety scale and all the tests were scored for each S. One hundred eighty-seven valid protocols were obtained. One hundred sixty-four students, all except those falling in the middle third on both test anxiety and self-acceptance were then asked to participate in an aptitude testing procedure sponsored by a vocational testing company. Those who did were promised a free vocational interest appraisal (Kuder Preference Record) as a reward. Over 86 per cent of the students asked, volunteered for the experiment. The potential Ss were classified in terms of scores in the high and low thirds of the test anxiety and self-acceptance measures and then assigned to one of three groups; control, failure, or neutral.

All Ss were seen individually. The control Ss merely retook the Index of Adjustment and Values. Failure Ss performed six trials of Kohs Block Design #13 in what they thought was an aptitude testing situation. They were then told that they had scored in the bottom quarter of their group and were given a new design, Kohs Block Design #16. After one trial on this task they were again told that they had failed and were asked to take the Index of Adjustment and Values. The neutral group underwent the identical procedure as the failure group except that the failure evaluation after Kohs #13 was omitted. They were first told that they had failed after Kohs #16. After retaking the Index of Adjustment and Values, Ss were encouraged to express their feelings and were informed of the specious nature of the failure evaluations.

The results did not substantiate the hypothesis that Ss with high test anxiety perform more poorly on the first trial of the learning task than Ss with low test anxiety. It was also found that Ss with high test anxiety did not improve with practice so as to equal or surpass the low test anxiety group on later trials. The hypothesis that high self-acceptance was related to efficiency of performance was also rejected. No significant differences were found between any of the groups. In a like manner, results showed that test anxiety and self-acceptance were not related to performance after induced failure. These results may in part have been caused by the low reliability of the performance task but even when the most reliable measure,

score on all six trials of Kohs Block Design #13, was analyzed, no significant differences were obtained. These findings did not replicate the positive results of Mandler and Sarason with test anxiety scale.

Although self-acceptance was found to have no relationship to task performance, the hypothesis that change in self-acceptance after failure is a function of initial self-acceptance was sustained. The Ss with initially high self-acceptance lowered their self-acceptance as a result of failure and the Ss with low self-acceptance raised their self-evaluations.

Extraversion-introversion was shown to have no direct relationship to change in self-evaluation.

70 pages. \$2.00. Mic 57-2562

ABILITY AND ADJUSTMENT AS DETERMINANTS
OF VOCATIONAL INTEREST PATTERNING IN
LATE ADOLESCENCE

(Publication No. 21,603)

John Orr Crites, Ph.D.
Columbia University, 1957

Chairman: Donald E. Super

The problem investigated was based upon the question: Are ability and adjustment determinants of vocational interest patterning? The question was formulated because the various theories of the origin and development of vocational interests have not been in agreement with respect to the contributions of ability and adjustment to the formation of interest patterns; because there have been inadequacies in the design of research studies on the relationship of ability and adjustment to interests; and, because there was an apparent need for the development of a method for the quantitative expression of all the information yielded by a Strong vocational interest profile. The purpose of the present study was, then, to provide further research evidence concerning ability and adjustment as sources of vocational interests by devising an experimental design which was both appropriate to the theoretical problem and adequate for the analysis of total interest patterning.

The procedure which was used emerged from a consideration of how ability and adjustment have been defined and measured, how the total interest pattern might be quantified to represent all of its characteristics, and what methods of statistical analysis have been followed to interpret the results of previous research studies. In the definition of ability and adjustment distinctions were made (1) between the conceptions of ability as symbolic intelligence and as achievement, and (2) between two aspects of personality, mode and quality of adjustment. Upon the basis of these distinctions tests were chosen for the study which would measure symbolic ability and quality of adjustment. Scores on these two variables were then related to three characteristics of the interest pattern: elevation, scatter, and shape. The statistical analysis of the relationships of ability and quality of adjustment to elevation, scatter, and shape followed the variance interpretation of the correlation coefficient and differences between

groups, using both parametric and nonparametric techniques.

The general hypothesis was formulated that variations in ability and quality of adjustment contribute to the total variance in the elevation, scatter, and shape of the interest profile. For each combination of ability and adjustment with the three aspects of the interest profile the null hypothesis was established and tested on a sample of 70 adolescent boys who were in the senior year of high school. The results indicated that ability contributed significantly to the total variance in elevation and shape, adjustment influenced variations in elevation, and neither ability nor adjustment affected the variance in scatter. The conclusion was drawn that the findings did not support the elimination of either ability or quality of adjustment as possible determinants of the various characteristics of interest patterning; that the relative contribution of ability to interest patterning in late adolescence was greater than that of adjustment; and, that differential aspects of the interest profile were affected by ability and quality of adjustment.

Implications of the findings for the construction of an adequate theory of vocational interests, further research, and counseling practice were outlined.

96 pages. \$2.00. Mic 57-2563

FACTORS IN THE UNDERSTANDING OF OTHERS

(Publication No. 21,633)

Helen A. Diers, Ph.D.
Columbia University, 1957

Chairman: E. Joseph Shoben, Jr.

This study was concerned with relationships between a person's understanding of others and similarity, liking, and introversion. It was hypothesized that:

- (a) the understanding of others is positively related to the similarity between the Judge and Subject.
- (b) the understanding of others is positively related to a Judge's liking for a Subject.
- (c) the understanding of others is positively related to the social and thinking introversive tendencies of the Judge.
- (d) the understanding of others is negatively related to the social and thinking introversive tendencies of the Subject.

The subjects of the experiment were 60 Junior and Senior student nurses who had known each other for at least a year and a half. The subjects were divided into 12 five-member groups on the basis of class level, work assignment, and observed social contacts. There were seven Senior groups and five Junior groups.

Each subject was asked to respond by a "Yes" or "No" answer to a modified form of Guilford's Inventory of Factors STDCR and to predict the responses of the other members of her group to the same items. Each subject was also instructed to rank the other members of her group according to how well she liked them.

These procedures permitted the estimation of relationships by correlational techniques on the basis of the following scores: Prediction Accuracy, Similarity, Liking Ratings, Social Introversion, and Thinking Introversion.

The hypothesis of a positive relationship between prediction accuracy and similarity was confirmed. An analysis of this result on the basis of stereotypy and attribution indicated that this relationship (a) is independent of stereotypy and (b) is largely the effect of successful attribution of self responses.

The expected positive relationship between prediction accuracy and liking was not supported. It was further found that stereotypy does not seem to be an important factor in relation to liking and prediction accuracy. Positive relationships between liking and similarity and the tendency to attribute self responses suggest that liking can be an indirect index of prediction accuracy provided the Judge and Subject are similar.

The results of the third and fourth hypotheses relevant to the introversive traits of Judges and Subjects demonstrated the pervasive effects of similarity on prediction accuracy. An analysis of the results suggested that only the negative correlation between the social introversive characteristics of the Judge and prediction accuracy is independent of the effects of similarity. Therefore, while the data indicate that prediction accuracy is negatively related to the social and thinking introversive traits of the Subjects, this relationship stems essentially from the relationship between prediction accuracy and similarity.

The finding that similarity strongly influences prediction accuracy was interpreted in relation to theory and research. The question was raised as to whether this relationship as measured reflects the extent to which similarity and its concomitant successful attribution dominates interpersonal understanding. The importance of experimental control of the effect of similarity on prediction accuracy was stressed in research on this problem.

A theoretical approach to prediction accuracy was presented based on an analysis of the operations involved in the act of predicting the responses of another. It was proposed that this ability functions at four levels of discrimination corresponding to the conditions represented by the four categories of items differentiated in this study: stereotyped-concordant, nonstereotyped-concordant, stereotyped-nonconcordant, and nonstereotyped-nonconcordant.

74 pages. \$2.00. Mic 57-2564

THE RELATIONSHIP BETWEEN CERTAIN PERSONALITY CHARACTERISTICS AND PROGNOSIS IN REMEDIAL READING INSTRUCTION: AN INVESTIGATION TO DETERMINE WHETHER CERTAIN PERSONALITY CHARACTERISTICS FOUND IN CHILDREN WITH READING DISABILITIES CAN BE PREDICTIVE OF PROGRESS OR LACK OF PROGRESS IN INDIVIDUAL REMEDIAL READING INSTRUCTION

(Publication No. 21,699)

Carroll Alfred Fellemann, Ph.D.
New York University, 1957

The purpose of this investigation was to determine the relationship between personality characteristics and the ability of children to progress in individual remedial reading instruction.

To achieve this purpose it was necessary to assess the personality characteristics, reading level, and physical

status of a group of children referred to the Educational Clinics of Brooklyn, City, and Queens Colleges who were between the ages of eight and fourteen, who were of at least dull normal intelligence, who were two or more years retarded in reading with respect to mental age, and who had neither gross sensory defects nor damage to the central nervous system. Those children who had received three college terms of remediation were retested to determine the amount of progress made in reading. Two groups were formed - one consisting of the children who made more than a year's progress and one of children who made less. After equating the groups for sex, chronological age, number of remedial sessions, intelligence, and level of reading at the onset of remediation, fifteen children in each group were found who met these requirements. The personality characteristics of the children of each of the groups were compared in terms of individual factors and holistic evaluations by three judges. The individual characteristics which emerged as significantly different were subjected to cross validation procedures.

It was hypothesized that there is a relationship between certain personality characteristics and the extent to which a child can profit from individual remedial reading. Specifically, those children with greater emotional control, greater awareness of reality, less internalized emotional conflict, and less need to perceive reality in a vague, undifferentiated manner make more progress in reading.

The children were examined initially and subsequently retested by the staff psychologists in the respective Clinics. The tests employed were: The Stanford-Binet Scale, The Rorschach Technique, The Gates Reading Diagnostic Tests, The Gray Oral Reading Paragraphs, and one of The Gates Silent Reading Tests appropriate to the child's reading ability. Each child received a physical examination by the staff pediatrician. Individual remedial reading instruction was conducted by graduate students, under the supervision of the staff psychologists.

Comparisons between the progress group and the lack of progress group revealed the following results:

1. The children of the progress group came from homes in which there were two parent figures while a significant number of children in the lack of progress group were living with one or no parent figure (institutionalized).

2. The lack of progress group showed a significantly greater intellectual oppositionalism than the progress group in the experimental phase of the study but the extent of difference was not maintained with the cross validation groups - although the results were in the same direction as found in the experimental phase.

3. The lack of progress group was found to perceive reality less accurately and to maintain less adequate emotional control. These factors showed a tendency to differentiate significantly the cross validation groups.

4. Judgmental evaluations of the total Rorschach protocols, whereby the characteristics of reality awareness, emotional control, internalized emotional conflict, and manner of perception were assessed, significantly differentiated the progress group from the lack of progress group.

5. A significant relationship was found between degree of emotional disturbance and ability to progress in remedial reading.

The following conclusions were made:

1. There is a significant relationship between personality characteristics and ability to progress in reading as a result of individual remedial reading instruction.

2. Specific personality characteristics can be predictive of progress and lack of progress in remedial reading.
3. The child who is less emotionally disturbed is a better risk for individual remedial reading instruction than the one who is more disturbed.

212 pages. \$2.75. Mic 57-2565

THE USE OF THE VINELAND SOCIAL MATURITY SCALE IN THE PLANNING OF AN EDUCATIONAL PROGRAM FOR NON-INSTITUTIONALIZED LOW-GRADE MENTALLY DEFICIENT CHILDREN

(Publication No. 21,702)

Monroe George Gottsegen, Ph.D.
New York University, 1956

There have been many conflicting claims in regard to the efficacy of rehabilitating the mental defective. A critical need was found to exist for accurate and precise evaluation of methods which claim to effect changes in social status. As the result of an effort to improve social competency in the non-institutionalized low-grade mentally defective child, methods for deriving curriculum goals objectively from the Vineland Social Maturity Scale were developed.

The following questions were then raised:

What would be the nature and extent of the improvement resulting from an educational program primarily devoted to the attainment of objectively determined social goals?

To what extent would such a program, primarily devoted to social education, meet the needs of the non-institutionalized mentally defective child?

Twenty-three subjects living and attending classes in the Bronx and twenty-six subjects living and attending classes in Brooklyn fully completed an experimental program of social education which was set up to answer the above questions. A flexible experimental procedure permitted conclusions based upon differences both within and between these two groups of subjects. Goal plans were drawn for each of the subjects who participated in the experiment. These goal plans were based on the categories contained in the Vineland Social Maturity Scale. The experimental program of social education was geared to the quantitatively derived individual needs of the subjects.

Significantly positive changes in social quotients were considered to be reflections of advances in social competency. Differences between the means of the social quotients that were significant at the one per cent level were produced in both groups as a result of the introduction of the goal plan procedures. Although no significant differences were noted between the Bronx and Brooklyn groups to begin with, significant differences in social quotients occurred between the groups following the introduction of the goal plan procedures into the Bronx group. These social quotient differences decreased, however, when the Brooklyn group was given the opportunity to benefit from the same procedures which were initially introduced and later withdrawn from the Bronx group. At the conclusion of the experiment, the Bronx and Brooklyn groups showed no significant differences between them in regard to their mean social quotients. The Bronx group showed no significant changes in social quotients over a four month post-experimental period.

The following conclusions may be made:

1. Social competency can be significantly improved if teaching efforts are directed toward remedying the major deficiencies of the defective child.
2. The goal directed teaching procedures based upon an analysis of individual deficiencies are capable of contributing to fairly stable increases in social competency.
3. Behavior equivalent to borderline-normal standards of social competency is reached by only a small minority of subjects.
4. In regard to individual subjects, the more adequate the initial level of social competency appears the greater are the chances that significant changes in social competency will occur.
5. Speech disorders proved least responsive to corrective efforts.
6. The experimental method allowed for a sensitive quantitative appraisal of behavior.

The following recommendations are offered:

1. Objective evaluation procedures should be used to gauge social development.
2. An active teaching role is advocated in order to encourage increases in social competency.
3. Teaching procedures should take into consideration the poorly integrated development presented by the non-institutionalized mentally defective child.
4. Parents might profitably assist their children in improving social competency if given a carefully developed plan to follow. However, periodic re-evaluation of a child's home progress is necessary in order to provide the required elements of flexibility.

213 pages. \$2.80. Mic 57-2566

FAMILY DRAWINGS AND ADJUSTMENT

(Publication No. 21,612)

Rhoda L. Lorand, Ph.D.
Columbia University, 1957

Chairman: Irving D. Lorge

This study was undertaken in an attempt to find an objective means of determining emotional maturity from children's drawings of their family.

A total elementary school population of boys and girls from kindergarten through the eighth grade in a New York public school were asked to draw a picture of a same-sexed person and a picture of their family including themselves. The children's emotional maturity was evaluated by their teachers through the Haggerty-Olson-Wickman Behavior Rating Schedules. Drawings of Person, Mother, Father, and Self were rated on the Lorge-Dunn Scale for rating the maturity of drawings by boys and girls. The Scale was put to a new use in that boys' drawings of Mother were rated on the section of the Scale developed from girls' drawings of girls. Similarly, girls' drawings of Father were rated by means of the boys' scale of drawings of boys.

The hypotheses tested were: (1) A correlation exists between the maturity of the child's drawing of his family and his emotional adjustment. (2) The completeness with which a child draws his family correlates with emotional

adjustment. (3) A significant difference in the maturity of the child's drawing of Self and either parent, and a significant difference in maturity ratings between parents, correlates negatively with adjustment. (4) A significant difference between the maturity ratings of Person and Self correlates negatively with adjustment. The theoretical basis of these hypotheses is that a disturbance in the child's emotional adjustment is a function of his relationship with his parents and will be expressed in omissions, partial representations and/or an immature drawing level of parents and himself.

Correlations were computed using the 317 cases in which there were no total omissions of parent figures or the self. The remaining 175 cases were used for comparisons of means of sections of the distributions for both groups on Haggerty-Olson-Wickman scores and on maturity ratings of drawings.

The findings are: (1) Correlations between rated maturity of family figures and H-O-W scores were all significant at the .01 level but were small. (2) Of the group of children who omitted one or more family figures, the boys had higher scores* on H-O-W Schedule B, Division 2 (the estimate of physical appearance and energy) than did the boys who drew all the figures in some degree. (3) Girls who drew Mother in some degree of incompleteness had higher mean H-O-W scores than girls who drew Mother completely. (4) Boys who drew Self partially had higher mean H-O-W Schedule A scores than did boys who drew Self completely.

Other sex differences found were: (5) Boys' drawings of Mother are significantly lower in maturity than girls', a difference significant beyond the .001 level. (6) Boys leave out Mother significantly more often than do girls. (7) Boys draw Mother, Father and Self in some degree of incompleteness significantly more often than do girls.

Additional findings, relating to hypotheses 3 and 4 were: (8) A high correlation in maturity rating was found between any two figures drawn by the same individual. (9) Large differences in maturity ratings among parents and Self had no relationship to Haggerty-Olson-Wickman scores. (10) Large differences in maturity ratings between Person and Self showed some relationship to maladjustment.

The conclusions are that although family drawings are correlated with adjustment, the low correlations indicate much overlapping. This indicates that the Lorge-Dunn Scale and the completeness score cannot reliably be used as a screening device to separate maladjusted from adjusted children.

122 pages. \$2.00. Mic 57-2567

*A higher score indicates a greater number of problem tendencies.

**THE EFFECTS OF INDUCED STRESS
ON THE MANAGEMENT OF HOSTILITY
IN ESSENTIAL HYPERTENSION**

(Publication No. 21,595)

Norman A. Neiberg, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Austin W. Berkeley

This investigation studied the mode of hostility management in persons with essential hypertension. The mode of adjustment to hostile impulses of hypertensive persons was viewed as a defensive adaptation which was different from the normal mode. The hypothesized differences between these groups were to be observed under two conditions, one with and one without hostility arousal. Under both conditions it was predicted that the hypertensive would be over-inhibited with respect to expressions of hostility. In the first condition a higher level of inhibition and tension was expected to characterize the hypertensive group. Under the second condition greater change from the earlier levels of inhibition and tension were also expected to characterize the hypertensive group.

The independent variable of essential hypertension was defined on the basis of presence or absence of a medical diagnosis of essential hypertension. The second independent variable was hostility arousal. The method employed was an adaptation of the Wisconsin card sort that involved punishment for failure.

The dependent variable of tension was measured by two indices - heart rate and blood pressure. Heart rate was measured prior to hostility arousal. Change in level of heart rate and blood pressure were measured during and after the hostility arousing situation.

Two measures were employed for the dependent variable of inhibition. First, the E scores on two equivalent halves of a multiple choice form of the Rosenzweig Picture Frustration test were obtained. One half was administered prior to stress and the other following stress. Second, a measure of verbalized aggression was obtained on a Direct Questionnaire administered in the poststress situation only.

The operational predictions were as follows:

1. Prior to hostility arousal the hypertensive group will have a lower E score on the Rosenzweig PF test, than will the normotensive group.
2. Prior to hostility arousal the hypertensive group will have a higher heart rate than will the normotensive group.
3. Following hostility arousal the hypertensive group will show a greater drop in E score on the PF test than will the normotensive group.
4. During hostility arousal the hypertensive group will show greater increases in blood pressure and heart rate from its prestress baseline than will the normotensive group.

Predictions I and II were supported. Prior to hostility arousal hypertensive persons were both more tense and more inhibited with respect to hostile expression than were normotensive persons.

Predictions III and IV were not supported. Contrary to the original formulation, hostility arousal produced equivalent changes rather than differential effects when initial differences were taken into account.

A suggested reformulation of the findings holds that the hypertensive individual's over-inhibition of hostile impulses allows him to operate at a different level of equilibrium than does his normal counterpart. His life development is such that once having developed essential hypertension he cannot express himself as freely as the normal. Consequently, when seen in the initial condition, he appears both more inhibited and more tense than does the normotensive. From this higher level of equilibrium, however, he responds to stress with heightened reactions which, relative to his baseline, are not unlike those of the normal.

115 pages. \$2.00. Mic 57-2568

**A STUDY OF FACTORS LEADING TO CHANGE
WITHIN THE PERSONAL CONSTRUCT SYSTEM**

(Publication No. 21,447)

David Keith Newman, Ph.D.
The Ohio State University, 1956

The problem was developed within the framework of the psychology of personal constructs. The purpose of the study was to investigate factors that are related to changes made in the elemental structure of the construct system. Hypotheses of relationship were developed and rephrased in the form of experimental predictions based on the following four propositions:

1. The invalidation of the individual's prediction of self-movement on a construct dimension will lead to more changes in the structure of the construct than will validation of predicted self-movement.
2. The invalidation or validation of predicted movement will lead to more changes than the invalidation or validation of predicted no-movement.
3. The predicted ordinal relationships of the four conditions in terms of the most construct change to the least construct change is as follows: the invalidation of movement; the validation of movement; the invalidation of no-movement; the validation of no-movement.
4. There will be a positive relationship between the individual's total estimate of self-movement and the flexibility of construct application.

Method. One hundred and twenty-six female college students filled out a modified version of the Role Construct Repertory Test. This was followed by the administration of a specially constructed self-movement scale on which the subject estimated how much she had changed during the past three years on each of the construct dimensions. The first session ended with the administration of an unauthentic personality test. In the second session, the protocols were returned with "information" confirming or denying the estimates of movement or no-movement on three constructs. The subjects were told that this information was based on the results of the personality questionnaire. The second session was completed by instructing the subjects to make whatever changes in the structure of their constructs they felt were appropriate.

Results. The first two hypotheses were partially confirmed. Predictions based on changes made in the three involved constructs were supported, while predictions based on changes in all of the constructs were not. The third and fourth hypotheses were both supported. The

implications of the results for personal construct theory and for psychotherapeutic practice were discussed.

Conclusions. By considering the variable of construed self-movement, the prediction of construct change can be refined. The individual's perception of self-movement along a construct dimension seems to be related to the construct's inclusiveness of new elements, figures, and ideas. Thus, it is concluded that the proposition of this study can, through further verification and elaboration, contribute to the understanding and predicting of construct variability.

99 pages. \$2.00. Mic 57-2569

ATTITUDES RELATED TO ADJUSTMENT IN A HOME FOR THE AGED

(Publication No. 21,614)

Muriel Oberleider, Ph.D.
Columbia University, 1957

Chairman: Professor Edward J. Shoben, Jr.

The behavior of institutionalized aged persons was studied in relation to their attitudes towards old age. From the postulate that aged individuals are more likely to become frustrated and maladjusted in instances where earlier life goals are retained and conformity to the cultural patterns for the aged is resisted, it was hypothesized that:

A group designated as "Management Problems" as compared to a group designated as "Institutionally Adjusted" is characterized by:

1. more expressed denial of the stereotypes of the aged;
2. more expressed retention of the goals and values of earlier maturity;
3. more expressed disturbances over changes associated with the aging process.

To test the hypotheses, a 176-item questionnaire was prepared consisting of five subscales; (1) Stereotypes; (2) Anti-Stereotypes; (3) Older Values; (4) Younger Values; and (5) Functional Inadequacy, yielding five separate scores. A final item, scored separately, indicated changes in ideas since age forty-five.

The test-retest reliabilities of the subscales were satisfactory for group use: Stereotypes, .87, Anti-Stereotypes, .88, Older Values, .88, Younger Values, .75, and Functional Inadequacy, .73.

The study was conducted in a progressive home for the Jewish aged in New York City. The experimental groups consisted of twenty persons each, of average age 78, and were comparable with respect to age, sex, marital status, parenthood, nationality, occupation, health, years in the U. S., and in the home. All subjects had volunteered to participate in the study.

In general, the results supported none of the hypotheses that initiated the study, but statistically significant findings suggested guides for further research.

Hypothesis 1 was essentially contradicted by the results, the Institutionally Adjusted showing significantly greater disagreement with the stereotypes of the aged, (between the .02 and .01 levels). Hypothesis 2 was also contradicted by the results, the Institutionally Adjusted showing significantly greater acceptance of younger values,

(between the .05 and .02 levels). The two groups did not differ significantly in respect to the other subscales.

In view of significant positive correlations between Stereotypes and Older Values, and between Anti-Stereotypes and Younger Values, it was suggested that patterns of response may have been related to the type of variable, e.g., whether it was culturally or individually determined.

Further examination of the data suggested the possibility that the Institutionally Adjusted had accepted old age, despite their espousal of the younger viewpoint, whereas the Management Problem group had not accepted their age, although they expressed the older viewpoint on the questionnaire.

In general, the results seemed consistent with the concept of adjustment as a relatively pervasive ability in which past experience, awareness of the environment and others, and creative self-expression are important factors. The Institutionally Adjusted seemed able to adjust in an integrative and self-fulfilling fashion, and their ability to find outlets for their participation and achievement drives was reflected in a low degree of frustration, aggression, and hostility.

The study offered some evidence for self-esteem and feelings of inadequacy as factors in institutional adjustment. There was some indication that aged persons, while they accepted culturally determined values and stereotypes, endorsed the opposite points of view as well when given the opportunity.

72 pages. \$2.00. Mic 57-2570

THE EFFECT OF DISABILITY ON SELF-CONCEPT

(Publication No. 21,127)

Irving Shelsky, Ph.D.
Columbia University, 1957

Chairman: Donald E. Super

The present study investigated the effect of injury and illness on self-concept. A review of the literature indicated that the disabled individual's perception of the effect of the illness or injury on himself has been inadequately studied with a lack of experimentally controlled evidence.

Chronic illness and injury change an individual's situation in a manner that is not clearly understood. The work of Rogers and his associates suggests that an individual's behavior may be better understood if we see his perception of his past and present situation. Previous research has indicated that self-concept theory was a useful theoretical framework within which to study the problem.

The major aims of this study were to investigate the effects of disability on self-concept, and to determine whether or not there is a differential effect of dissimilar disabilities on self-perception. Two disabilities that were basically different disease entities and which had no typical pre-illness or pre-injury personality were used. They were amputation and pulmonary tuberculosis. A control group of individuals with acute short-term illness were used to compare with the disabled groups.

The Gough Adjective Check-List was administered in groups of four. The subjects were instructed to describe their retrospective, present and ideal-self perceptions. The subjects included 60 tuberculous, 60 amputees and 30

controls who were native born, male patients in the New York City Metropolitan area Veterans Administration General Medical and Surgical Hospitals. Age, education, marital status and religion were controlled. Length of hospitalization and time since diagnosis were held constant between the two disabled groups, but the nature of the control group precluded controlling for these two variables. All subjects were tested during the recovery phase of their illness.

The following results were obtained:

Amputation and tuberculosis influence an individual's retrospective, present and ideal-self perceptions.

Amputation and tuberculosis differentially influence an individual's retrospective, present and ideal-self perceptions.

The tuberculous are more self-rejecting and less self-accepting than the controls.

The amputees are not significantly more self-rejecting and less self-accepting than the controls, although the results approach significance (10%, 6% level) in the predicted direction.

There is no significant difference between the amputees and the tuberculous on self-acceptance or self-rejection.

The discrepancy between the retrospective and present self-perception is greater for the amputees than the controls.

No significant differences exist between amputees and controls on the discrepancy between the retrospective and ideal, and present and ideal-self perceptions.

The discrepancy between the retrospective and present self perceptions and the present and ideal-self perceptions are greater for the tuberculous than the controls.

The discrepancy between the retrospective and the ideal-self perceptions is not greater for the controls than the tuberculous. The results obtained were significantly different in the direction opposite to the one hypothesized.

No significant differences exist between the amputees and the tuberculous on the discrepancy between their retrospective and present self-perceptions.

Discrepancies between retrospective and ideal-self perception, and between present and ideal-self perception, are not greater for the amputees than for the tuberculous. These discrepancies are significantly greater for the tuberculous than for the amputees.

These results are interpreted as showing that disability affects the self-concept and that there is a differential effect of tuberculosis and amputation on the individual's self-perception. It is concluded that tuberculosis has more of an effect on the self-concept of an individual than do amputation and acute illness.

Implications are discussed in terms of the differential nature of the amputees' and tuberculous' somato-psychological situation.

Finally, several lines of research are suggested in order to investigate further the relationship between disability and self-concept. 84 pages. \$2.00. Mic 57-2571

AN EXPERIMENTAL TEST OF TWO ALTERNATIVE HYPOTHESES CONCERNING PEPTIC ULCER ETIOLOGY

(Publication No. 21,387)

Jacob Oliver Sines, Ph.D.
Michigan State University, 1955

On the basis of a review of the literature concerning the role and the nature of the psychogenic factor in the etiology of peptic ulcer, two alternative hypotheses were selected to be put to an experimental test. The hypotheses were: (1) the Alexander and French formulation that an unresolved conflict concerning passive-dependent needs was the anxiety producing conflict in persons with peptic ulcer, and (2) the formulation presented by Mahl that the anxiety which leads to the gastric hyperactivity necessary for peptic ulcer formation need not result from a conflict concerning passive-dependency needs alone. Rather, any stressful situation might serve to activate the autonomic nervous system and thus start the physiological chain of events which eventuates in peptic ulcer.

In order to test these hypotheses, three so-called "crucial" pictures and a fourth, a neutral picture, were employed. The crucial pictures were called "Hostile", "Passive", and "Sexual" depending upon the group from which they evoked the greatest number of increased autonomically mediated physiological responses. The neutral stimulus provided the "basal" level of autonomic activity from which changes were calculated. There were three groups of patients in the validation study, all of whom had been carefully interviewed and tested by an advanced pre-doctoral clinical psychology student or a staff clinical psychologist in a large Veterans Administration hospital. One group of patients (N of 8) was considered by the supervising staff clinical psychologist to be primarily conflicted concerning the expression or control of hostile-aggressive impulses, another group (N of 7) exhibiting anxiety primarily as a result of conflicts over the expression of passive-dependent needs, and a third group (N of 5) who seemed to have as the basis of their anxiety, conflicts over the expression or inhibition of sexual impulses. It was found that when these three groups of subjects were presented with the stimulus pictures at least two of the three physiological systems measured by the Keeler Polygraph were characterized by increased activity. The increases in autonomically mediated physiological activity in each group tended to occur with greater than chance frequency following presentation of the stimulus picture which was selected for its relationship to the conflict hypothesized for each group.

These pictures were then presented to the peptic ulcer and control groups. There were twenty four subjects in each group. When the proportion of increased physiological responses made by the peptic ulcer group following the presentation of the "Passive" stimulus was compared to the proportion of such responses made by an appropriate control group, there were no significant differences.

This was interpreted as supporting the position taken by Mahl and refuting the Alexander and French hypothesis.

A re-statement of Mahl's "generality" theory concerning the psychogenic factor in peptic ulcer etiology was made on the basis of the results of the present study as well as several others recently published. A few general

suggestions about continued research in the area of psychosomatic disorders were offered.

94 pages. \$2.00. Mic 57-2572

FORM PERCEPTION, ABSTRACT THINKING AND INTELLIGENCE TEST VALIDITY IN CEREBRAL PALSY

(Publication No. 21,652)

George Rothwell Stephenson, Ph.D.
Columbia University, 1957

Chairman: Laurance F. Shaffer

This study investigated whether two types of mental deficit ascribed to brain injury in cerebral palsy, impaired form perception and deficient abstraction, are evident in test performance on intelligence scales suitable for cerebral palsied subjects with severe speech and motor disabilities. The study also investigated the validity of such tests for the cerebral palsied and the comparative validity of tests composed of homogeneous and heterogeneous types of items. A battery consisting of two language tests, the Ammons Full-Range Picture Vocabulary Test and the Non-Vocal Scale of Mental Functioning, which was constructed as part of this research, and two nonlanguage tests involving perception of visual form, the Columbia Mental Maturity Scale and the Raven Progressive Matrices (1947), was administered to groups of cerebral palsied and non-cerebral palsied subjects. The experimental and control groups comprised 36 pairs of subjects, 20 mentally defective and 16 nondefective, 5 to 18 years of age, matched for age and educational achievement as rated by teachers. Using the consensus of three judges, test items were classified as concrete or abstract. The means of differences between paired individuals were analysed for four item classifications, using standard scores based on control group performance; validity was compared by correlating test mental ages with rated academic achievement.

Experimental and control groups did not differ significantly with respect to means or standard deviations for age, achievement ratings or median mental age on the test battery. In comparison with control subjects, cerebral palsied subjects scored significantly lower both on concrete nonlanguage items and on abstract nonlanguage items but failed to score significantly higher on concrete language items or significantly lower on abstract language items. The discrepancy between language and nonlanguage scores was significantly greater for cerebral palsied subjects at the .001 level; the discrepancy between concrete and abstract scores was not significant. The language-nonlanguage discrepancy was apparent for both mentally defective and nondefective groups of cerebral palsied subjects, occurred independently of diagnostic classification, and showed a nonsignificant tendency to increase with severity of physical involvement. The concrete-abstract discrepancy was evident only for the mentally defective group of cerebral palsied subjects and did not approach significance. Although the proportion of abstract items was greater in nonlanguage tests than in language tests and the relative difficulty of items for the cerebral palsied tended to increase progressively from concrete language to abstract nonlanguage categories, there was no significant

relationship between item difficulty and item abstractness, independent of the language-nonlanguage dichotomy. Test validity did not differ significantly in the control and experimental groups. The heterogeneous language test failed to yield significantly higher measures of validity than did the homogeneous vocabulary test, except for mentally defective non-cerebral palsied subjects.

While the experimental results are consistent with the prevailing impression that impaired form perception in cerebral palsy restricts functioning on nonlanguage tests, the negative findings with respect to items rated as abstract are contrary to previous research. It would appear that, by emphasizing perceptual and conceptual factors, nonlanguage tests have stressed abstract mental functions to a greater extent than have language tests and that inferences regarding impaired abstraction in cerebral palsy have been based primarily upon nonlanguage functioning. If deficient functioning on nonlanguage tests does reflect inadequate form perception and abstraction, consideration of mental processes common to both should lead to a basic theoretical formulation which would account for these and other psychological correlates of brain damage. Speculation suggests that in brain injury an incompletely elaborated complex of relationships among elements of past and present experience restricts the capacity for integrative thinking essential to abstraction and form perception.

121 pages. \$2.00. Mic 57-2573

ANXIETY AND CONCEPTUAL IMPAIRMENT IN SCHIZOPHRENIA

(Publication No. 21,653)

Donald Tomblen, Ph.D.
Columbia University, 1957

Chairman: Paul E. Eiserer

A major problem in developing a comprehensive theoretical explanation of schizophrenia has been to determine the essential nature and cause of the schizophrenic thought disturbance. This study investigated a key hypothesis derived from one current solution to the problem. The solution is that of Arieti and is based upon the earlier formulations of Sullivan and Goldstein. Arieti views the thought disturbance as a manifestation of impaired conceptual functioning, or a "loss of abstract ability." He further maintains that the conceptual impairment is a reaction to and a defense against anxiety. The hypothesis of the present study was thus that the conceptual impairment of schizophrenics relative to normals is significantly greater under anxiety conditions than under neutral conditions.

The hypothesis was tested twice by separate but allied techniques, Object Sorting Tests and Picture Sorting Tests. The experimental subjects were 34 young, white, male paranoid schizophrenics who had been hospitalized for an average of two and one-half months and had not been treated by drugs or shock. The control subjects were normals, matched with the schizophrenics for age, education, and vocabulary. On each technique, 17 schizophrenics were compared with 17 normals in terms of conceptual functioning on a Neutral Test and an Anxiety Test.

All subjects were tested individually, first on the Neutral Test and then one week later on the Anxiety Test. A complete quantitative scoring system was devised and found to be reliable. The system yielded a Total score, plus subsidiary scores for the major aspects of conceptual functioning, Conceptual Level, Concept Span, Adequacy of Verbalization, Active Sorting, and Passive Sorting.

Results of both techniques confirmed the hypothesis at the .01 level of significance. This result held not only for Total scores but also for all subsidiary scores. Several further analyses of the data were included to give a broader view of results. The finding that anxiety impairs all aspects of conceptual functioning in schizophrenics relative to matched normals was discussed in its implications for theory and practice. The theoretical positions of Goldstein and Arieti seem most comprehensive and penetrating, especially since they bring schizophrenia within the same framework of general knowledge as the neuroses.

The conceptual impairment of schizophrenics may be seen as a reaction to and a defense against anxiety, just as are the symptoms of neurosis. With a loss of abstract ability, the schizophrenic loses such adaptive capacities as self-directedness, flexibility, and tolerance for frustration. More and more situations are beyond his powers to cope adequately, and he responds with more and more anxiety, which further impairs abstraction. A vicious cycle is thus seen to be operating in schizophrenia.

In addition to these theoretical implications, the study is considered as part of the general search for relationships between cognitive and affective behavior. Implications for psychotherapy, diagnosis, prognosis, and hospital management of schizophrenics are discussed. The limitations of the study are enumerated, particularly those of small sample, new techniques, and restricted scope of the hypothesis itself. Further research is suggested to establish the defensive function of conceptual impairment. It was suggested that the method of the study be extended to neurotics and organics. Other research suggestions included testing the relationship of conceptual impairment to varying degrees of illness and recovery, and examining the possible value of anxiety-arousing picture sorting tests as diagnostic instruments for the early detection of disturbed thinking.

118 pages. \$2.00. Mic 57-2574

THE EFFECT OF MASCULINITY ON PROJECTION AS ELICITED BY MALE AND FEMALE FIGURES AND SITUATIONS

(Publication No. 21,318)

Aare Truumaa, Ph.D.
Purdue University, 1957

Major Professor: Edith Weisskopf-Joelson

This study was designed to determine whether psychosexual similarity between a person and a pictorial figure or situation in a projective test affects the amount of his projection.

The subjects were male undergraduate students at Purdue University, selected on the basis of their performance on the Gough Test of Psychological Femininity. A "high masculinity" group was composed of 26 subjects who

scored most masculine on the test, a "low masculinity" group consisted of 26 subjects who scored most feminine, and an "intermediate masculinity" group of 27 subjects was drawn from the middle of the masculinity-femininity distribution.

A modification of a series of 20 pictures, developed by Wexner, was used to elicit projection. The series included four pictures each from five general areas of living. Pictures in each area portrayed one "male" situation with a "neutral" figure, one "female" situation with a "neutral" figure, and two identical "neutral" situations, one with a male figure and the other with a female figure. The situations were classified as "male," "female," or "neutral" according to whether they were experienced or thought about more by males, females, or fairly equally by both sexes. The "neutral" figures were figures with no definite sexual characteristics.

Group administration was used and the subjects were requested to write stories according to the standard TAT instructions. Four and a half minutes were allowed for each picture. Each subject took the test in two sessions, one week apart. Ten pictures were administered in each session. The amount of projection given to each picture was determined by the Weisskopf Transcendence Index, a scoring device which counts the number of comments which go beyond pure description of the picture.

The results indicated that sexual characteristics of the pictorial figures did not affect the amount of projection given to the pictures by men of different degrees of masculinity. Nor did the masculinity groups differ in their projection on "male" situations, as compared with their projection on "female" situations. All groups tended to give more projection to "male" than to "female" situations, but only in the low masculinity group this tendency reached statistical significance (at the one per cent level). The high and the low masculinity groups produced significantly more overall projection than the middle group.

The findings and limitations of the study were discussed and suggestions for further research in the area of similarity between the pictorial situations and the subject were offered.

126 pages. \$2.00. Mic 57-2575

FACTORS CONTRIBUTING TO POSITIVE SOCIAL INTERACTION IN GROUPS OF SCHIZOPHRENICS

(Publication No. 21,621)

Jack C. Wanger, Ph.D.
Columbia University, 1957

Chairman: Joel Davitz

Is it possible to create a climate in a mental hospital in which schizophrenics could interact socially in a therapeutic manner? An affirmative answer to this question would prove a great boon to understaffed institutions which cannot offer individual or group psychotherapy to every patient who could profit from such an experience. With this long-range objective in mind, the present study was designed to determine some of the factors associated with positive interaction among schizophrenics as a start towards the creation of informal therapeutic groups on hospital wards.

The hypotheses of the experiment were specifically concerned with predictions about personality characteristics that would differentiate the better social interactors from those less able to interact well in social situations. Effective social interaction was defined by means of four criteria: (1) social status as perceived by the S's peers, (2) social status as perceived by the staff, (3) a sample of the S's interaction in a group situation, and (4) expressed reactions about the S's role in the group situation. The two social status scores were derived from sociometric devices administered to the patients themselves and the members of the staff of the hospital who were best acquainted with the sample of patients participating in the experiment. The interaction sample was analyzed by means of Bales' Interaction Scale, and the reaction of the S to the group interaction was computed from a five-point scale checked by the S.

The relative social effectiveness of the S's, as reflected by the four criteria mentioned above, were the bases for testing the following hypotheses:

1. Social effectiveness among schizophrenics is positively related to ability to delay gratification of impulses.
2. Social effectiveness among schizophrenics is positively related to degree of self-acceptance.
3. The more socially effective schizophrenics describe themselves in a similar manner.

The four impulse control subtests, Rorschach M, Porteus Maze, Motor Inhibition Task, Time Estimation, did not intercorrelate to a sufficient degree to provide one score of impulsivity. For this sample, therefore, the subtests were not measuring the same trait and as a consequence the first hypothesis could not be tested.

To test the second hypothesis self-acceptance scores of the S's were ascertained from a 200-word adjective checklist. The discrepancy between the self and ideal-self ratings on the checklist formed the basis of the self-acceptance score. The product-moment correlations between self-acceptance and social effectiveness did not support the hypothesis. In fact, there was some evidence to support the hypothesis that more socially effective schizophrenics have a lower degree of self-acceptance than those whose social effectiveness is low.

The last hypothesis was treated in an exploratory manner. The S's were ranked according to their degree of social effectiveness, and the self-description ratings of the high and low quartiles were compared. The results indicated that 53 words were checked more often by the low than the high quartile. Of these words, 47 were favorably toned and the other 6 were neutral words. In contrast, the only word which was checked more often by the high than the low quartile was an unfavorable word.

In discussing the results, some limitations of the impulse control battery and the type of S's used were pointed out, with the conclusion being that the impulse control battery should be used with caution until further experimental research provides more evidence of its reliability and validity. In regards to the self-acceptance theory tested in the second hypothesis, it would seem that the theory was contradicted in this study in that schizophrenics who accepted themselves the least interacted most favorably with others. This finding was explained primarily as illustrating the excessive use of the mechanism of denial of illness by the poorer interactors. The disparity between the self-concepts of the high and low quartiles of socially effective schizophrenics re-affirmed not only the extreme

use of denial by the poorer interactors, but, in addition, their grandiose, unrealistic self-evaluation as opposed to the humble self-appraisal of the better interactors.

Suggestions were made for future investigations with the impulse control battery and the self-acceptance theory. More experimentation would be useful in terms of identifying other characteristics of the good interactor with the view towards instituting a therapeutic program centered around these key members of the patient society.

74 pages. \$2.00. Mic 57-2576

CLINICAL VERSUS STATISTICAL PREDICTION WITH A METHOD OF EVALUATING A CLINICAL TOOL

(Publication No. 21,622)

George Henry Weinberg, Ph.D.
Columbia University, 1957

Chairman: Laurance F. Shaffer

Recently the problem of clinical versus statistical prediction has attracted widespread attention. The purpose of the present study was to test three hypotheses relating to this problem. The first hypothesis was that statistical predictions are more accurate than clinical predictions made from the same case history data. The second was that clinical predictions from case history data may become less accurate when new evidence of low validity is introduced. The third was that statistical predictions from case history data are more accurate than clinical predictions from the same data in addition to Rorschach findings.

Three instruments were used to test these hypotheses. One was a case history checklist designed to elicit information usually recorded in admission folders. The second was a personality Q Sort similar to the one used by Rogers and Dymond. The third was the Rorschach test.

Forty psychotherapists filled out checklists and did Q Sorts on 51 of their patients. These patients were non-psychotic adolescent males, nonpsychotic adult females, and borderline psychotic adult males. The data concerning 12 patients, four in each category, were set aside and an actuarial table was constructed from the remaining materials. The table converted the case histories of the 12 patients into statistical predictions about them in the form of Q Sort distributions.

Twenty-four psychologists, working independently, also made Q Sort predictions about the 12 patients from their case history data. The psychologists then studied the patients' Rorschach protocols in addition to their case history data, and Q Sort described the patients again. Thus statistical and clinical predictions were made from case history data, and clinical predictions were made from Rorschach and case history data combined. The predictions were all made about the same 12 patients and the therapists' Q Sort descriptions of them served as criteria.

No significant difference was found between the statistical and clinical predictions from the same case history data. The statistical and the clinical predictions made from the case history data were both more accurate than the clinical predictions made from the case history and Rorschach data combined.

Several possible explanations were offered for the failure to find a significant difference between the clinical and statistical predictions from the same data. The actuarial table was criticized and shortcomings of the design which might have decreased the efficiency of either the clinical or the statistical predictions were discussed. The possibility that clinical and statistical predictions from the same data are of about equal validity was noted. The finding that the introduction of Rorschach evidence decreased the efficiency of clinical predictions was considered to have implications for the controversy over clinical versus statistical prediction. The possibility was suggested that the efficiency of clinical weighting is a function of the number of available cues. Several suggestions were made for future research with various kinds of evidence.

56 pages. \$2.00. Mic 57-2577

EFFECTS OF CHRONIC AND STRESS-INDUCED ANXIETY ON RORSCHACH DETERMINANTS

(Publication No. 21,655)

Fred Wise, Ph.D.
Columbia University, 1957

Chairman: L. F. Shaffer

Much disagreement has existed between the claims of nonexperimental users of the Rorschach and the research findings as to the ability of the instrument to measure the presence of anxiety. A further unresolved issue has been the influence of temporary environmental pressures on performance. The present investigation, therefore, was undertaken to determine the influence on Rorschach determinants of chronic anxiety and situational stress.

The Taylor Manifest Anxiety Scale was administered to 154 medical corpsmen at a U. S. Air Force Base. The 40 highest scoring subjects were considered to be highly anxious and the 40 lowest subjects were considered to be of low anxiety. Half the subjects in each group were exposed to a stress situation, which consisted of being told that the results of the first test had showed them to be emotionally disturbed. Loss of four subjects reduced the number of members in each of the ultimate four groups to 19. The four groups consisted of low anxiety control, low anxiety experimental, high anxiety control, and high anxiety experimental. The Rorschach Test, a number-subtraction test, and a self-rating anxiety scale were administered to all subjects.

It was hypothesized that there would be significant differences among groups in performance on the number-subtraction test, as well as significant differences in Rorschach performance in regard to fifteen determinants often regarded as signs of anxiety. There were significant differences among groups in scores on the self-rating scale, indicating that experimental procedures brought about variations in sensed anxiety.

Three experienced judges were asked to assign each subject to his group on the basis of any cues they deemed useful. This technique offered an opportunity to compare clinical judgments with the more formal sign approach.

The results of the investigation were as follows:

1. There were significant differences among groups

and between three pairs of groups in the number of errors made on the number-subtraction test. There were no significant differences among groups for elapsed time on the number-subtraction test.

2. Of the fifteen alleged indices of anxiety on the Rorschach, four (number of responses, number of rejected plates, oligophrenic details, and shading shock signs) differentiated among groups in the manner hypothesized and at an acceptable level of significance. Number of responses distinguished significantly between one pair of groups, as did number of rejected plates. Oligophrenic details and shading shock signs distinguished significantly between three pairs of groups.

3. The performance of all the judges was better than might be expected by chance alone. The results achieved by two of the judges was better than chance expectancy to a statistically significant degree, and the results achieved by the third judge, while not statistically significant, were good enough to be termed suggestive. The percentage of agreement among judges on correct assignment of protocols differed from chance expectancy to a statistically significant degree in all cases.

In a crude way some of the determinants distinguished among groups. The results of the study, however, suggest a very low validity for generally accepted signs of anxiety. Although global handling of the protocols by judges produced results that were significantly better than chance, their average performance was only 44 per cent correct assignments. It is therefore indicated that even maximal inspection of the protocols by skilled clinicians does not result in adequate discrimination of individuals. The study failed to reveal discrimination between chronic and stress-induced anxiety either by Rorschach signs or clinical judgments.

72 pages. \$2.00. Mic 57-2578

STABILITY OF TEST PERFORMANCE OF SCHIZOPHRENIC PATIENTS

(Publication No. 21,624)

Alvin Wolf, Ph.D.
Columbia University, 1957

Chairman: Donald E. Super

Standardized psychological tests, which are believed to call for varying degrees of emotional involvement, were used in order to ascertain whether the pattern of variation in schizophrenic test-retest performance supports the concept of impairment of particular functions in schizophrenia.

The total sample consisted of 72 schizophrenic subjects and 72 nonpsychotic subjects who were equated for age, intelligence, and educational background. The schizophrenic and nonpsychotic subjects were divided into two groups and each group was given a comparable battery of aptitude, achievement, and interest tests according to the standard instructions. One month later, the same tests were administered again to each subject.

The initial test and retest raw score results of the schizophrenic subjects were compared with those made by the nonpsychotic subjects. In addition, tests of homogeneity of variances were applied to the schizophrenic and

nonpsychotic subjects, as well as tests of homogeneity of variances within each of the groups of subjects. Retest reliability coefficients were also computed for the schizophrenic and nonpsychotic subjects.

The results indicate that schizophrenic subjects do perform significantly less well than nonpsychotic subjects. Shakow's¹ concept of nonorganic mental deterioration in schizophrenia was felt to be applicable. Schizophrenic subjects also tended to show greater variability in their test-retest performances. However, they obtained sufficiently high retest reliability coefficients to suggest that these tests may be used with confidence in appraisal work with schizophrenic patients. Furthermore, no gradation in variability of performance with the type of test administered was found, suggesting that the theoretical concept of schizophrenia affecting stability of performance in specific areas of functioning lacks validity.

84 pages. \$2.00. Mic 57-2579

1. D. Shakow. The nature of deterioration in schizophrenic conditions. *Nerv. ment. Dis. Monogr.*, 1946, No. 70.

AN EVALUATION OF THE CANDIDATE EMPLOYEE PROGRAM IN THE REHABILITATION OF PSYCHIATRIC PATIENTS

(Publication No. 21,465)

Fred Holmes Wright, Ph.D.
The Ohio State University, 1956

Modern psychiatric hospitals are in the process of undergoing a second major transition. The first involved a shift from punitive prisons to protective hospitals stressing custodial care. The second involves a shift of emphasis to rehabilitation to community life. This research was concerned with the organization, administration, treatment, and evaluation of a program emphasizing preparation for community adjustment.

The Candidate Employee Program was effected with two major objectives. One was to provide a practical testing situation in which the hospital staff could appraise patients' readiness for discharge more realistically. The other objective was to orient patients to the problems of community adjustment and provide them with opportunities to adapt to a more normal life.

The structure of the program consisted of a special ward, weekend passes, access to money, a counseling psychologist as supervisor, individual and group counseling, and opportunities for community employment.

The subjects were selected largely upon the recommendation of staff members closely associated with the patients. There was an age maximum of 50 and a minimum I.Q. of 85. During the period under evaluation, a total of 34 patients participated in the program and an additional 19 were in the control group.

An evaluation of this program was made after nine months, on the basis of environmental status criteria, such as employment in the community; test-retest criteria--the Curtis Completion Form, an incomplete sentences blank designed to measure work orientation and adjustment level, and the Index of Adjustment and Values, a

measure of self and ideal self concept and others and ideal others concept; and rating criteria based on before and after scores on a modified version of the Hospital Adjustment Scale. Experimental and control groups were utilized.

The purpose of the evaluation was to determine the effectiveness of the program by the three types of criteria used. Secondary questions involved investigation of the validity of the measures as criteria of progress in therapy, as discriminators between more and less successful cases, and as predictive indices. In addition, variables ascertainable at the beginning of the experiment were explored in relation to subsequent outcome.

The results of the experiment indicated that in terms of environmental status criteria, such as community employment, the C.E.P. was significantly successful at the 1 per cent level of confidence. These criteria were considered the most important since they were identical with the goals of the program. Behavioral ratings done by the psychiatric aide were significantly more favorable after the experiment at the 5 per cent level. The results of the use of the Curtis Completion Form and the Index of Adjustment and Values were inconclusive. Both showed improvement in the experimental group after the C.E.P. However, this improvement was not statistically significant.

It was also found that the Curtis and Index did not distinguish potentially successful from unsuccessful candidates. The unsuccessful group showed significantly more improvement on the Index. The validity of these two tests for this purpose is questioned.

Of several variables tested for significance in predicting later success, only length of hospitalization had predictive value at the 5 per cent level.

On the basis of the evidence obtained with environmental and behavioral rating criteria, especially the former, the writer concludes that, for this type of chronic psychiatric patient whose gross psychotic symptomatology has subsided, the Candidate Employee Program is significantly more effective in facilitating return to productive life than is the routine treatment even in a progressive hospital. The writer further recommends the expansion of the program in the original hospital and in other similar institutions. This expansion has already begun.

119 pages. \$2.00. Mic 57-2580

PSYCHOLOGY, EXPERIMENTAL

AUTOCORRELATION AND CROSSCORRELATION ANALYSES OF TRACKING BEHAVIOR

(Publication No. 21,466)

William Francis Bennett, Ph.D.
The Ohio State University, 1957

Performance in tracking tasks is usually specified in terms of root mean squared (RMS) error scores, time-on-target scores, or the frequency with which the subject successively acquires and then loses a target. Although such behavioral descriptions are important, they do not provide a basis for insight into those characteristics of

skill or skill learning which result in a given level of performance.

The nature of autocorrelation and crosscorrelation techniques permits analysis of tracking behavior in terms of frequency analyses. The major purpose of this investigation was to apply these measures in analyzing underlying behavioral characteristics in various tracking tasks. One major investigation and three pilot studies were undertaken.

In the major investigation, 24 male subjects were randomly divided into four equal groups. Each group practiced on a different tracking task. These tasks were (a) tracking a periodic target course with a pursuit display, (b) tracking a periodic target course with a compensatory display, (c) tracking a random target course with a pursuit display, and (d) tracking a random target course with a compensatory display. Each subject received 13 two-minute trials per day on four consecutive days.

Conventional performance indices included one RMS error score, three time-on-target scores, three transition scores, and a graphic record of control movement. Photometric records of the signal, the control movement, and the error were also taken. The photometric records were processed through the O.S.U. Photometric Correlator to obtain graphic autocorrelation and crosscorrelation functions, from which three quantitative scores were taken.

One measure derived from the error autocorrelation function was an Index of Error Coherence, which is interpreted as indicating the proportion of the power of the error signal that is coherent with target frequency. A second measure derived from the error autocorrelation functions was the value of Tau required for the function to fall to 0.5 of its value at $\tau = 0$. This measure is interpreted as reflecting the frequency composition of the random portion of the error. A third measure, derived from a crosscorrelation of signal input and control output, is interpreted as reflecting the average time by which the subject's response led or lagged the stimulus.

The Index of Error Coherence indicated that the random target courses were 85-95 per cent coherent with target frequencies and there was neither a difference between the pursuit and compensatory displays nor a change with practice. The error frequency for the periodic compensatory task was about 55 per cent coherent with the signal, and no change occurred with practice. The error frequency for the periodic pursuit task was about 40 per cent coherent with the target frequency, and this decreased to 11 per cent at the end of practice.

Performance in tracking periodic and random target courses was clearly distinguished by the measure reflecting the frequency composition of the random portion of the error signal. There was, however, no difference between pursuit and compensatory displays in this respect, and only the random compensatory task indicated a progressive shift in frequencies with practice.

Concerning the lead-lag analysis, the subject's response, for the periodic pursuit task, anticipated the signal by approximately 0.1 sec., and this did not change with practice. For the remaining three tasks, the subject lagged the signal, and the value of this lag decreased with practice.

Measures derived from autocorrelation and crosscorrelation functions, emphasizing differential frequency and phase characteristics of tracking behavior, appear to be valuable analytic tools. Results of pilot studies concerning

the effects of fatigue, muscle tension, and lag indicated that these techniques can also be used to great advantage in analyzing behavior in such tasks.

112 pages. \$2.00. Mic 57-2581

ASYMPTOTIC LEVEL, SHIFT RAPIDITY AND CONDITIONAL RELATIONSHIPS IN A TWO-CHOICE LEARNING SITUATION

(Publication No. 21,565)

Robert Alan Botenberg, Ph.D.
Stanford University, 1957

The purpose of the study was to evaluate the adequacy of Estes' statistical learning model as a representation of probability learning over a wide range of reinforcement ratios. Four questions were investigated experimentally (1) agreement between terminal response level and reinforcement ratio, (2) constancy of the growth parameter, θ , with variations in initial response level and reinforcement ratio, (3) effect of the direction of reinforcement uncertainty shift on θ , (4) extent of sequential dependencies between responses and previous response and reinforcement events.

Twelve groups of 16 Ss each were given a series of 120 random reinforcements at one reinforcement ratio which was followed immediately and without warning by a series of 120 reinforcements at a different ratio. S's task was to predict on each trial which of two lamps would flash. Groups were differentiated experimentally by combinations of Series 1 and Series 2 reinforcement ratios. A maximum likelihood criterion was used in estimating θ .

Measures of terminal response level agreed closely with some reinforcement ratios but were significantly more extreme than extreme reinforcement ratios. θ estimates were highly related to the difference between initial response level and reinforcement ratio. No relationship was evident between θ and direction of the reinforcement sequence uncertainty shift. Significant sequential dependencies were found between responses and previous response events. The differential effect on response strength of correctly predicting one reinforcement alternative versus incorrectly predicting the opposite alternative was found in general to exceed θ .

Predictions of the model were not confirmed by the results except for instances of agreement between terminal response level and reinforcement ratio and the independence of θ and uncertainty shift. It is shown that a generalized model of the type being discussed is not capable of yielding a relationship between reinforcement ratio and predicted asymptotic response level having the same general form as obtained in the study. It is concluded that the inclusion of previous response and response-reinforcement joint events within the system is probably required to fully explain the results.

73 pages. \$2.00. Mic 57-2582

THE CONSTRUCTION AND VALIDATION OF THE
U. S. NAVAL SCHOOL, OFFICER CANDIDATE,
SELF-DESCRIPTION BLANK

(Publication No. 21,697)

Francis Emile Brodney, Ph.D.
New York University, 1957

The major training school for Naval Reserve officers is the U. S. Naval School, Officer Candidate (OCS), at Newport, Rhode Island. Upon completion of this 16 week course, the Officer Candidate (OC) is commissioned an Ensign, USNR, and goes on active duty.

An applicant for the OCS program must hold a baccalaureate degree from an accredited college. He must be physically fit for active duty. His psychological characteristics are determined by an interview (Personality Rating), a test (Officer Qualification Test), an examination of records (Scholastic Records and Number of Credit-Hours in Mathematics and Physics), and an assessment by the Selection Board (Selection Board Evaluation).

The purpose of this study is to construct and validate a Self-Description Blank (SDB) which, when added to the current OCS selection battery, will significantly increase its predictive efficiency. The purpose is divided into three subproblems:

1. To determine the effectiveness of the current selection battery.
2. To construct and validate an instrument which will provide an independent prediction of OCS performance.
3. To determine the effects of the addition of the new instrument to the current selection battery.

Data were collected on a random sample of 416 OC's in Class 15. These data included scores on the five predictors currently used in OCS selection, scores on the SDB developed in this study, and the final weighted composite OCS grades.

A 300 item SDB was constructed. The first 100 were five-alternative biographical items. The next 50 were four-alternative attitude items which dealt with authoritarian-equalitarian concepts. The remaining 150 items were forced-choice tetrads to which a most descriptive and a least descriptive response were requested.

Multiple correlation coefficients of the current selection battery against the final weighted composite OCS grades with and without the SDB were computed. The two multiples were tested for significance of difference.

The 416 OC's used in the study were divided randomly into two samples of 208 each. The experimental sample was used to select items. The hold-out sample was used to obtain an operational estimate of SDB validity and the multiple validity of all predictors.

The current selection battery, when weighted optimally, correlates .558 with the final weighted composite OCS grades.

The SDB correlates .735 with OCS grades. This validity is based on the experimental sample and is spuriously high because of capitalization on chance in item selection. An unbiased estimate of the validity is obtained by using the same key on the hold-out sample. The validity in this case is .211. The reliability of the SDB is .743 on the experimental sample and .289 on the hold-out sample. One hundred and twenty-nine items have one or more valid alternatives when keyed using the experimental sample. On re-keying these items on the hold-out sample, only 28 retain the same keying.

The large drop in validity, reliability, and number of stable items suggests that the SDB is heavily loaded with items with only chance validity.

When the SDB scores are added to current predictors scores, the multiple correlation coefficient is raised to .583. This increase is statistically significant at the 1 per cent level.

It is recommended that the validity, validity increment, and reliability of a test made up of the 28 stable items be studied for possible operational application.

203 pages. \$2.65. Mic 57-2583

DRUG ADDICTION AND DELINQUENCY: AN
EXPERIMENTAL STUDY IN PERSISTENCE UNDER
CHANGING CONDITIONS OF REINFORCEMENT

(Publication No. 21,605)

Irwin Bernard Gould, Ph.D.
Columbia University, 1957

Chairman: Joel R. Davitz

The current investigation experimentally examined the phenomenon of persistent maladaptive behavior. The literature indicated general theoretical agreement on the paradoxical quality of maladaptive behavior in that individuals falling into this category have a tendency to persist in behavior that is predominantly unrewarding. However, the literature failed to indicate adequate experimental evidence for this position.

The major aim of the current investigation was to experimentally demonstrate persistent maladaptive behavior within a group of maladjusted S's. Individuals with drug addiction and delinquency were exposed to a punchboard which involved a shift in the correct, rewarded response half-way through the experimental task. A control group without drug addiction or delinquency but otherwise comparable was used for purposes of comparison.

The following hypotheses were tested:

1. Drug-addicted delinquents, delinquents with drug addiction, and non-drug-addicted delinquents, exceed controls in persisting in predominantly unrewarding behavior.

2. Within a group of hospitalized drug-addicted delinquents, those individuals who persist in predominantly unrewarding behavior return to the use of drugs sooner within a defined period of time after leaving the hospital than do those who do not persist in predominantly unrewarding behavior.

3. Within a group of hospitalized drug-addicted delinquents those individuals who persist in predominantly unrewarding behavior change jobs more frequently and remain on a job a shorter period of time than those individuals who do not persist in predominantly unrewarding behavior.

To test the first hypothesis the punchboard, Otis Self-Administering Test of Mental Ability and the Cornell Selectee Index were administered to four groups of subjects. The S's included 39 drug-addicted delinquents hospitalized at Riverside Hospital in New York City; 58 delinquents with drug-addiction and 53 non-drug-addicted delinquents institutionalized at the New York State Training School at Coxsackie, New York; and 51 control S's

from the Fashion Industries High School in New York City. The variables of ethnic origin, measured psychopathology, I. Q. and learning strength, initial motivation and reading skill as measured by performance on the first 60 items of the punchboard were demonstrated as not contributing significantly to differences in persistence as measured by the punchboard. The second and third hypotheses were tested on the Riverside group only.

The following results were obtained:

1. There were no significant differences in persistence in predominantly unrewarding behavior among the three maladjusted groups.

2. There were significant differences in the hypothesized direction in persistence in predominantly unrewarding behavior between the combined maladjusted group and the controls.

3. Within the Riverside addict group there was no significant difference as to the time of return to the use of drugs after leaving the hospital between those individuals who persisted in predominantly unrewarding behavior and those who did not.

4. Within the Riverside addict group there was no significant difference as to the number of jobs held, or the average length of time on a job after leaving the hospital between those individuals who persisted in predominantly unrewarding behavior and those who did not.

The results were interpreted in terms of maladaptive behavior manifesting itself through persistent predominantly unrewarding behavior. Further, the possibility was considered that drug usage, as subjectively experienced by the drug addict, in comparison with his hierarchy of needs, may not represent predominantly unrewarding behavior to him.

Implications were discussed in terms of the similarities between drug addicts and delinquents, and the differences that obtained within each of these groups.

It was suggested that further research might be directed toward identifying other areas of similarity and difference between drug addicts and delinquents for purposes of relating these data to differential history and reaction to rehabilitative approaches.

62 pages. \$2.00. Mic 57-2584

THE SIGNIFICANCE OF CRITICAL FLICKER-FUSION THRESHOLDS IN CEREBRAL PALSID CHILDREN

(Publication No. 21,608)

Seymour Halpern, Ph.D.
Columbia University, 1957

Chairman: Maurice Fouracre

This study was undertaken to find out whether CFF differentiates between the brain-damaged and the non-brain-damaged and to explore the possible usefulness of critical flicker-fusion thresholds in the differential diagnoses of cerebral palsied children, that is, the separation of the essentially feeble-minded from those whose mental retardation is secondary to their handicap.

Three groups of children known to be normal, mentally retarded, and cerebral palsied were compared with respect to CFF. The groups were formed on the basis of

chronological age, mental age, sex, and presence of motor disabilities which were presumed to indicate brain-damage. Chronological age range for each group, in years and months, was: 1) cerebral palsied, 7-3 to 17-4; 2) mentally retarded, 9-8 to 16-0; 3) normal, 9-2 to 16-5. Mental age range in years and months was: 1) cerebral palsied, 5-5 to 12-3; 2) mentally retarded, 4-5 to 8-9; 3) normal, 9-3 to 18-5. Intelligence quotient range was: 1) cerebral palsied, 48 to 90; 2) mentally retarded, 44 to 77; 3) normal 95 to 128. The mean IQ, CA and MA for each group was: 1) cerebral palsied, IQ -- 70, CA -- 12-4, MA -- 8-2; 2) mentally retarded, IQ -- 60, CA -- 12-0, MA -- 7-0; 3) normal, IQ -- 108, CA -- 12-3, MA -- 13-0. The mean flicker-fusion threshold values in terms of cycles per second for each group were: 1) cerebral palsied, 32.6; 2) mentally retarded, 38.1; 3) normal, 41.3.

Statistical analyses ("t" tests) of the data revealed significant intergroup differences in CFF. The difference between the normal and retarded groups was significant beyond the 0.01 level. Only 4 retarded subjects exceeded the mean of the normal controls which was 41.3 cycles per second; 21 retarded children either equalled or exceeded the lowest normal CFF. The cerebral palsied children scored lower than either of the other groups. The difference between the palsied and normal children proved to be significant beyond the 0.01 level; the difference between the palsied and the retarded children was also significant beyond the 0.01 level. Only 9 palsied children equalled or surpassed the lowest normal score, none equalled the mean of the normal group; 12 palsied subjects exceeded the lowest score in the retarded group while only 3 exceeded the mean.

It is clear that intergroup differences indicate that the samples were representative of three distinct populations. The factors of chronological age and sex were found to be unrelated to differences in critical flicker-fusion threshold. Learning or practice effects could not be demonstrated to account for individual differences in CFF. Pearson coefficients of correlation which were computed to ascertain the relationship between general mental ability as measured by IQ and neurologic efficiency as indicated by CFF, showed that these were essentially unrelated. The figures were cerebral palsied, $r = 0.06$; mentally retarded, $r = 0.04$; normal, $r = 0.28$. In regard to the relationship between CA and CFF the correlation coefficient $r = 0.08$ indicated no relationship.

The hypothesis offered to explain the results represents a synthesis of the views of Goldstein and those of Landis, namely, the influence of brain damage which results in prolongation of stimulation (Goldstein) and temporal influences which gives rise to differences in neurologic efficiency (Landis) were reconciled. It was asserted that the descending order of neurologic efficiency was normal, retarded, and palsied. It was further suggested that the palsied children might have achieved higher scores had they not been doubly handicapped by structural damage and inadequate oxygenation of the blood. A further investigation is suggested in which it is proposed that CFF is an index which might well be used to select palsied children who would benefit from assisted retraining in proper breathing ventilation.

52 pages. \$2.00. Mic 57-2585

STUDIES OF VISUAL DISCRIMINATION BY RACCOONS

(Publication No. 21,289)

John Irwin Johnson, Jr., Ph.D.
Purdue University, 1957

Major Professor: Kenneth M. Michels

A series of experiments was conducted to determine the visual discrimination abilities of raccoons in regard to materials and tests used with the Klüver-Wisconsin General Test Apparatus. Knowledge of these abilities is prerequisite to obtaining behavioral comparisons between raccoons and other species, particularly primates, which have been extensively tested using this apparatus.

Separation acuity was tested by a chain pulling method, wherein the animal is required to draw in that one of two chains to which a food cup is attached. The distance between the chains is varied systematically. At a distance of 14 inches, raccoons discriminated intervals as small as 1/4 inch. However, there was a progressive decrement in discrimination accuracy for intervals smaller than 3 inches.

Object acuity was first investigated by measuring the relative difficulty of learning to discriminate different sizes of objects. The objects used differed only in form qualities: they were all the same color and brightness. Varying the maximum linear extent of objects from 1 to 6 inches had no effect on learning discriminations.

Therefore, a further experiment tested the discriminability of smaller objects. After a discrimination between 2 objects of 1 inch maximum linear extent was learned, replications of these objects having a maximum linear extent of 1/2, 1/4, and 1/8 inch were presented. The proportion of correct choices was used to indicate discrimination. At a distance of 5 inches, all objects were successfully discriminated, with no apparent differences from one size to another. Furthermore, discrimination of all sizes of objects improved with experience.

In connection with the acuity tests, information was obtained concerning more complex behavioral processes. The first three patterned string problems of the Harlow-Settlage Series II were solved by naive raccoons. However, they were unable to solve problem patterns in which the strings were crossed. While learning the object discrimination problems, the raccoons formed learning sets which enabled them to learn in one trial problems that they were originally unable to learn in the 216 trials allowed. Their learning set formation was superior to that reported for any subhuman species except higher monkeys and chimpanzees. 111 pages. \$2.00. Mic 57-2586

PARTIAL PRIMARY REINFORCEMENT AS A PARAMETER OF SECONDARY REINFORCEMENT

(Publication No. 21,739)

Richard Milton Klein, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Garry J. Margolius

The problem of this paper is to investigate partial primary reinforcement as a possible parameter of secondary

reinforcement. Although partial primary reinforcement is known to be important in many learning situations, there appears to be little systematic knowledge of its relationship to secondary reinforcement.

An experiment was performed in which (1) a neutral stimulus was present on every training trial, (2) a primary reinforcer was present on only some of these trials, (3) after training was completed, a test was made for the secondary reinforcing properties of the neutral stimulus. Six independent groups of albino rats were trained in a simple runway with food as the primary reinforcer and goal box brightness as the neutral stimulus. Each group received a different number of primary reinforcements, namely, 100%, 90%, 60%, 40%, and 20%, out of one-hundred-twenty training trials. Half of the subjects were trained on a white goal box and half on a black goal box. When training was completed, the alleyway was converted to a T maze with white and black goal boxes. Neither goal box was visible to the subjects until after entrance. The animals were given twenty trials in the T maze, and the number of times they entered each goal box was tabulated.

Analysis of the data revealed that the lower the percentage of reinforcement given during training, the greater were the number of entries into the training box during the test. Some characteristics of the function were: between 100% and 90% the strength of secondary reinforcement did not increase, between 90% and 80% there was a large increase, from 80% to 40% there was a further increase, and from 40% to 20% there was some decrease. It was also revealed that some subjects in the lower percentage of reinforcement groups went either to the training box or to the novel box on every test trial. Other aspects of the data were also analyzed.

From this data a number of conclusions were drawn:

1. Partial primary reinforcement is a parameter of secondary reinforcement. Decrease in partial reinforcement results in an increase in secondary reinforcement. Various characteristics of this relationship were discussed. It was pointed out that the obtained function might be derived from two separate functions: the relationship of secondary reinforcement to the number of reinforced trials, and the relationship of secondary reinforcement to the number of non-reinforced trials.

2. The fact that some subjects went to the same box on every test trial was explained in terms of the development of strong secondary reinforcement, in the case of subjects who went to the training box, and in terms of the development of strong generalized secondary reinforcement, in the case of subjects who went to the novel box.

3. It has often been reported in the experimental literature that partially reinforced subjects show greater resistance to extinction than continuously reinforced subjects. Our findings can be applied to this phenomenon. Stimuli present during partial reinforcement are apt to acquire greater secondary reinforcing properties than those present during continuous reinforcement, and, hence, the presence of the former during extinction are able to maintain a higher frequency of responding than the presence of the latter. This hypothesis was distinguished from others offered in the literature which purport to explain the greater resistance to extinction in terms of secondary reinforcement.

4. It was pointed out that this experiment revealed a significant variable, secondary reinforcement, which might develop in studies whose training set up resembles ours.

5. Minor findings of the experiment were discussed.
77 pages. \$2.00. Mic 57-2587

THE EFFECTS OF SHOCK THREAT ON THE USE
OF CONTEXT STIMULI IN LEARNING

(Publication No. 21,768)

Martin T. Rebhun, Ph.D.
New York University, 1957

Adviser: Professor Robert E. Silverman

This experiment investigated the influence of shock threat on the responses of human subjects to relevant (stimulus words in paired-associates) and incidental stimuli (color backgrounds). Eight groups of 12 subjects each were required to learn a list of nine paired-associates. The even numbered groups learned under the threat of electric shock. Each pair of associates was placed on either a solid color background with a different color being used for each pair, or on a set of gray backgrounds. Twenty-four hours following acquisition of the paired-associates, all groups were tested for retention and relearning under four different conditions. For groups 1 and 2, both color backgrounds and paired-associates were exactly the same as during learning. Groups 3 and 4 had the original list but now on uniform gray backgrounds. Groups 5 and 6 were treated the same as groups 1 and 2 except for one variation in the conditions of recall and relearning, in that the stimulus member of each pair was not presented. Groups 7 and 8 learned the list on homogeneous gray backgrounds and recalled and relearned them under the same conditions as groups 5 and 6.

The results indicated that Ss exposed to the threat of electric shock made greater use of the stimulus words of the paired-associates than Ss not exposed to shock threat. The shock group also was not as markedly influenced by the contextual color stimuli as the no shock group.

Shock threat apparently elicited a narrowing of attending response which occurred at the expense of attending to context cues.

The results were interpreted as lending support to the hypothesis that stress increases relevant attending, i.e. attending to the primary or relevant cues in a situation.

58 pages. \$2.00. Mic 57-2588

THE EFFECTS OF SIMULTANEOUS AND
SUCCESSIVE CORTICAL LESIONS AND
POSTOPERATIVE PRETRAINING UPON
PATTERN VISION IN THE RAT

(Publication No. 21,460)

John David Snide, Ph.D.
The Ohio State University, 1956

The purpose of the present experiment was to ascertain some of the variables which may have operated in the visual pattern discrimination experiment performed by Meyer, Snide, and Anderson to produce results different

from those obtained by Lashley and Frank. The order of operations and the presence or absence of postoperative pretraining were selected as the variables to be investigated.

Thirty male hooded rats randomly selected from the animal colony at the Ohio State University were employed as subjects. The animals were trained to discriminate between diagonal striations in a modified Grice box.

All animals received preoperative pretraining and then discrimination training.

Next the animals were divided into 3 groups and subjected to symmetrically bilateral lesions of the visual cortex. Two groups received simultaneous decortications, and the third received successive decortications 12 days apart.

Postoperatively, one of the simultaneous groups received pretraining. Then all animals were trained in the discrimination box, and retention measurements were made. Also the appearance of visual tracking responses were measured by moving a pencil in the visual fields.

Measurements of the retention of the visual habit were highly significant. No overlap between the preoperative scores and the postoperative retention measurements for the simultaneously operated groups was obtained.

Comparisons between the savings scores for the groups indicated that the simultaneously operated group which received postoperative pretraining was significantly different from the simultaneously operated group which did not receive postoperative pretraining. No other statistical significances were obtained between the groups. It was concluded that a combined effect of the experimental variables may have occurred, but the experimental design was inadequate for this interpretation.

Comparisons between the visual tracking responses in the successively operated groups showed that the response was elicited sooner in the right than in the left visual field. This result suggests that the second operation which was performed on the left cortex delayed the recovery of function in the structures in the right side of the brain.

As compared with the simultaneously operated groups, the tracking response was evoked sooner in the right visual field for the successively operated groups and later in the left visual field.

No significant difference was obtained between the time of appearance of the response in the right and left visual fields for the simultaneously operated groups. These results were attributed to the effects of surgical shock.

A subsequent unpublished experiment performed by Meyer, Anderson, and Snide was considered in which an attempt was made to ascertain the validity of the results obtained with the modified Grice box in the present study. Various techniques were employed to ascertain the discriminatory cue to which the rats were responding. The results indicated that the animals were probably responding, not to the striate patterns, but to a visual cue, although it could not be identified.

The following conclusions were made:

1. If successive visual decortications are performed, the recovery of function in structures mediating visual sensitivity as measured by visual tracking on the side removed first is delayed by the subsequent removal of the contralateral side. Simultaneous visual decortications produce more severe shock effect than successive operations. The results may probably be attributed to the effects of surgical shock.

2. The postoperative savings scores cannot be clearly interpreted. Subsequent data indicate that the animals were probably not reacting to the patterns which were provided. The discriminatory stimulus which was operating is apparently so subtle as to be very difficult to ascertain although it is probably visual in nature. Special procedures employed to locate it were unsuccessful.

3. The validity of results obtained with a Grice box is called into question. 62 pages. \$2.00. Mic 57-2589

**THE EFFECT OF GAMMA RADIATION
ON THE REORGANIZATION OF A
LEARNED COMPLEX MAZE HABIT**

(Publication No. 21,039)

Albert Heinz Urmer, Ph.D.
The University of Texas, 1957

Supervisor: Dr. W. Lynn Brown

Forty female rats were trained to a criterion of three or fewer errors on an elevated T maze reproducing the

Tolman-Honzig maze pattern. After reaching criterion the Ss were divided into groups of twenty each. One half of each group was exposed to 400 r gamma radiation at a rate of 100 r per minute. One group continued training on a new maze pattern, randomly determined. Both groups continued training until they reached a criterion of one or less errors on any one trial.

The results indicated that this dose-rate of gamma radiation does not affect the retention of a task learned previous to radiation nor does it cause any decrement in postradiation improvement of performance on the same task. Exposure to this dose-rate does cause a decrement in the capacity of Ss to reorganize the response pattern, preradiation, into a new response pattern. The decrement is of temporary duration and of a quantitative rather than qualitative nature.

Similar to previous investigations, the running time was not significantly affected by exposure to this dose-rate of radiation, errors being the significant index of radiation effect.

88 pages. \$2.00. Mic 57-2590

RELIGION

AUTHORITARIANISM IN THE RELIGIOUS EXPERIENCE OF SAMUEL BUTLER

(Publication No. 21,543)

Virgil Victor Brallier, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Paul E. Johnson

This dissertation seeks to enter into the personality and religious experience of Samuel Butler as intimately as possible in order to understand the operation of authoritarianism in a single individual. Butler was chosen for study because of the controversial and deeply involved part he played in the transition from Victorianism to modernism. Butler has been an enigma because his writings reveal a man who saw through many of the weaknesses of authority, yet apparently without achieving the emancipation his writings suggest.

The procedure is fundamentally a psychoanalytic interpretation of Butler through a study of his writings and biographical sources. The objective of this approach is to show the ways in which religious experience is related to, conditioned by, or productive of authoritarian personality characteristics.

The first step is a content analysis of Butler's autobiographical novel, The Way of All Flesh. This analysis is to determine his attitudes to persons of authority, persons on a peer level, persons of subordinate rank and symbols of religious authority. A continuum of feelings ranging from love to hostility reveal the character of these relationships. One of the most striking facts is the large amount of hostility entering his relationships, especially with persons he conceives as superior to himself. His early self-conceptions are permeated with self-deprecating feelings. Later more positive feelings emerge.

A second principal instrument used in analysing Butler's character structure is a scale of twelve criteria comprised of the characteristics most commonly found in authoritarian persons. Ten of the criteria are descriptive of Butler. Some of the most prominent are his tendency to hold a threatening world-view, classifying persons in a hierarchy, strongly desiring status, manifesting hostility in relationships, using a single scale of values, a disguised exploitation of his closest friends, and an intolerance of ambiguity in all situations involving him emotionally.

The crux of the study lies in exploring the correspondences between Butler's religious experience, the character of his relationships and his personality structure. All the main features of his religious concepts and experience show striking similarities with his personality structure and with his relationships.

The most salient conclusions drawn from this study are as follows: (1) Butler's personality structure shows striking correspondence with the authoritarian character structure as defined by the best-recognized researchers in the field. (2) Butler reversed the direction of his sadomaso-

chistic drive from the pattern most prevalent in authoritarians, thus giving him what might be described as a rebel syndrome. Overt sadistic aggression was directed toward those in superior positions. The attitude toward his father provided the pattern for his relations with superiors. (3) Butler seemed to have problems with his sexual identification. His closest relationships were with peer-level males who were subordinates for all practical purposes. He never sustained affectual relationships with women. (4) The contrast between his highly developed intellectual maturity and his poorly developed emotional life provides one of the most important keys to understanding the Butler enigma. (5) Butler argued for the unknowability of God, rejecting any concept of transcendence. This corresponds with his rebel characteristic. (6) Butler's hostile relationship to the church was patterned after his relationships with all persons he conceived to be above him. (7) Butler sought a religious orientation through a teleological interpretation of life even though rejecting religious authoritarianism. (8) There seems to be a definite linkage between the unrealized hopes of Butler's life and the kind of immortality he sought, indicating elements of compensation arising from his drive for recognition. (9) An area calling for further exploration is Butler's longing for affection coupled with his consistent flight from loving relationships.

232 pages. \$3.00. Mic 57-2591

HOSEA BALLOU, PREACHER OF UNIVERSAL SALVATION

(Publication No. 21,544)

Ernest Cassara, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Edwin Prince Booth

This dissertation is devoted to a study of the life and thought of Hosea Ballou (1771-1852), the most prominent of the leaders of American Universalism. No major work has been published in this field since 1889; there has never been a careful examination of his thought and an attempt to trace its sources.

Ballou was the son of a Calvinistic Baptist minister. At eighteen he was converted to Universalism and began preaching the new "heresy" in about 1791 on a Calvinistic basis.

Between 1791 and 1795 Ballou's thought went through a radical transformation. This study attempts to show that the resultant unitarianism of Ballou was the fruit of his reading of Ethan Allen's deistical work, Reason the Only Oracle of Man. Allen, with his great stress on reason, destroyed Ballou's faith in the doctrines of the trinity and the divinity of Christ, the infinity of sin, and the traditional theories of the atonement. With the help of Charles

Chauncy's Salvation of All Men, which justified not only his belief in Universal salvation but also helped him to substitute the Arian for the trinitarian view of Christ, and to view the atonement as the reconciliation of man to God and not vice versa; and Ferdinand Olivier Petitpierre's Thoughts on the Divine Goodness, which helped him to see Christ's atonement as an expression of God's love, and also gave him a firm base for a theory of determinism; Ballou began the reconstruction of his religious thought. His first sermon on a unitarian and Arian base was preached in 1795. Within ten years, through the power of his argumentation, and against the opposition of the prominent Universalist John Murray, Ballou had converted the Universalist ministry to unitarianism. In 1805 his new thought was fully systematized in A Treatise on Atonement, a brilliant piece of reasoning and debating expressed in the language of rural America.

Ballou's Arian view of Christ eventually gave way to the Socinian view, under the influence of the writings of the English Unitarian Joseph Priestley. Liberalization and modernization of his Biblical interpretation is also evident by the time his Works were published in 1832.

Hosea Ballou's early ministry was spent in circuit riding, after which he settled in Portsmouth, New Hampshire, and Salem, Massachusetts. He began a ministry of almost thirty-five years in Boston in 1817, where his vigorous preaching was responsible for a rapid growth of Universalism. Although he was a unitarian long before the Unitarian movement began, Ballou was not welcomed by that group which, for social and doctrinal reasons, avoided association with the Universalists. This dissertation compares the thought of Ballou with that of William Ellery Channing, the most effective spokesman of the Unitarians, on vital issues between the two denominations.

Whereas in the early days Universalists had been content to oppose the orthodox on the basis of a limited future punishment, in 1817 Ballou concluded that no future punishment could be demonstrated from Scripture. His new views were partially responsible for the Restorationist Controversy which led to the secession of a small group of Universalists who insisted that a limited future punishment was necessary in God's plan. Ballou set forth his views in An Examination of the Doctrine of Future Retribution.

Hosea Ballou died in 1852, beloved and esteemed as the "Father" of the Universalist denomination. His effect on the rise of American religious liberalism was great. He was responsible for the conversion of Universalism to a unitarian base, a reasonable theory of atonement, and for warming the heart of the God of Calvinism.

387 pages. \$4.95. Mic 57-2592

THE ORIGIN AND DEVELOPMENT OF OLD TESTAMENT AND INTER-TESTAMENTAL BELIEF REGARDING LIFE AFTER DEATH

(Publication No. 21,589)

Wilma Esther Davis, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Elmer A. Leslie

Belief in life after death includes belief in God, and in man's awareness of spiritual things, since it is part of the

whole religious consciousness of man. Archaeological investigation has found the earliest knowledge of man connected with death: careful burial of the dead with weapons, utensils, and ornaments for use in the next world. His cultural development can be traced by his burial deposits. Burial entailed religious ceremony: cup-holes around the graves suggest libations; remains of feasts suggest funeral or memorial rites. By Chalcolithic times, many tombs had vestibule entrances with altars.

In Egypt people paid great attention to life after death, building elaborate tombs. Here was apparently the first distinction recognized between good and evil in the world beyond. Pictures on walls of early tomb-temples portray souls being weighed, and show the happy life awaiting the successful, and dangers in store for those who fail. Many Egyptian documents give magic incantations to insure a happy state in the next world. Mesopotamian epics recount attempts to attain immortality. Burial rites can be read from Hittite documents. Homeric epics tell a like tale. Similar rites were practiced in America.

Israel seems to have maintained a healthy interest in life on earth, with death only casually mentioned. The dead were "gathered to their fathers." Until the later writings, which may have been influenced by Persian concepts, the spirit life was but a shadowy existence. Sheol is a land of darkness and forgetfulness; the shades "cannot praise the Lord." In the later writings there are a few references to a happy state in the next world, but Daniel is the only prophet who speaks of a resurrection of both good and evil for judgment.

The victories of the Maccabaean revolt led to a return of high hopes for Israel, but when the new regime failed they lifted their expectations to a new plane, looking for an eternal glory that was more than earthly, and a Messiah of superhuman qualities. The newly-discovered Dead Sea Scrolls emphasize the Messianic expectations.

Meanwhile, all over the earth men were seeking light on the next world, and some way of being assured of a good place there. Mystery religions offered a resurrection of the god, developed from the old nature cults, and ceremonies to insure a good life in the spirit world for their devotees. Philosophers and astrologers were also teaching types of eternal life. Such developments show universal longing to overcome the tragedy of death.

The conquest of Alexander the Great opened the roads of the world. Greek influence moved eastward, and Oriental culture westward. The Jewish Dispersion placed the Jews in the center of this movement. The Pseudepigraphal writings reflect this influence, notably in the conception of life after death: vivid descriptions of the horrors of hell and the glories of heaven. There is a suggestion also that a few people would find the punishment of the lower world remedial, and would later be admitted to Paradise.

The Jews rejected anything that would lower their conception of God; the One and Only God, majestic and of great glory, but also their Father who showed steadfast love to his children of earth. They expected immediate entrance at death into places prepared for them "from the foundation of the world": for the wicked, places of torment; for the righteous, heavenly glories. They looked for a Messiah who would come to earth and restore the Paradise of Eden; a final Judgment when evil would be destroyed and the faithful rewarded; and after that a "new heaven and a new earth" where righteousness would prevail.

307 pages. \$3.95. Mic 57-2593

**PSYCHOLOGICAL ASPECTS OF THE PASTORAL
MINISTRY OF FRANCIS ASBURY**

(Publication No. 21,545)

Donald Delbert Douglass, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Paul E. Johnson

The purpose of this dissertation is to examine the ministry of Francis Asbury in the light of modern pastoral psychology. The study is to reveal the interpersonal relationships which existed between the pastor and his parishioners.

The study reveals that the work of Francis Asbury was basically a ministry to the individual. The mass meetings such as the class, the prayer meeting, and the camp meeting were in reality centered upon the individual. In the pastor's role as minister, the preaching ministry came first, then the visitation of the sick, the class meeting, and finally house-to-house calling.

Asbury used the group effectively in both preaching and in the class meeting. The use of the principles of the group were used to their fullest in the camp meeting. Asbury did not find the camp meeting movement but recognized its value in a scattered frontier. The rapid growth of the camp meeting was the result of its meeting the social and spiritual needs of this colonial people. Asbury was able to continue, in a large measure, the fruits of the camp meeting through the effective use of the class meeting.

Asbury found the group dynamics of the small class an effective means of promoting the Christian experience within the individual. As social conditions changed and the class meeting began to wane, Asbury saw fit to encourage the prayer meeting. The prayer meeting was less threatening to the individual confessor. It permitted the member to more easily control the rate of confession without the sense of the group's probing.

In the ministry to the sick and shut-in Asbury believed that the minister served a special function which none other could fulfill. This special function gave the minister unrestricted entrance into the sickroom. Visitation of the sick came second only to the preaching ministry in the life of Asbury.

As a counselor Asbury was very directive. He would lead the counselee into the areas of thought which he as the counselor considered important through a directing of the conversation. In such counseling Asbury often extracted the important facts of the interview and placed them in a concise summary. He would draw his conclusions and make his positive recommendations.

Asbury distinguished between his role as spiritual and secular counselor. In the area of spiritual counseling he felt an urgency for the counselee's conforming with his ideal. The nature of Asbury's ministry necessarily limited his counseling to brief counseling. The number of counseling sessions were limited by his continued traveling. Asbury referred to a form of counseling which he called, "individual preaching." In this he accepted a father's role. The success of this form of counseling depended upon the degree of established rapport.

Asbury believed that it was essential for the counselor to listen in order to understand his parishioner. Listening, however, was difficult for Asbury. His success in counseling was due largely to his friendly personality, his

fluent conversation, and his personal interest in the individual.

Much of the success of Asbury's ministry was due to his understanding of human personality, and his willingness to adjust his methods to the spiritual and psychological needs of his people. His continued success was the result of his dynamic and forceful personality.

218 pages. \$2.85. Mic 57-2594

**PROLEGOMENA TO A CHRISTIAN PHILOSOPHY
OF PENAL JUSTICE**

(Publication No. 21,546)

Dean Hosken, Ph.D.
Boston University Graduate School, 1957

Major Professor: Dr. L. Harold DeWolf

The purpose of this study is to examine the Christian attitude toward penal justice as exemplified in the history of theology and in the works of certain contemporary theologians, in an effort to discover the necessary components of a Christian philosophy of penal justice. Although the redemption of the lost is a primary concern of the New Testament, there has been surprisingly little systematic consideration of this problem in Christian theology. This work is meant to be only a preliminary study of this critical area of theological and social concern. It is suggestive rather than conclusive, pointing up places in which further investigation, preferably of an interdisciplinary nature, is needed.

The method is both historical and analytical. In Chapter One the presuppositions of such a study are examined: the nature of justice in general and of penal justice in particular, and the necessary relation between justice and love in a Christian society. In Chapter Two some of the effects of legalistic thinking on the history of Christian theology are shown. In Chapter Three a comparable study is made showing some effects of Christian thought on the history of penal practice. Chapter Four is devoted to an examination of the theological resources for formulating a Christian philosophy of penal justice. The theological basis of these resources is discussed as well as their relevance to penal practice. The practical aspects of the problem are considered in Chapter Five where an attempt is made to formulate an approach to a Christian philosophy of penal justice.

Although, in an introductory study such as this, any conclusions must be held tentatively pending further study, the following facts seem to be evident:

1. Christian theology itself has fostered much of the self-righteous vindictiveness which has characterized the public's attitude toward the criminal.
2. Therefore a Christian philosophy of penal justice must guard against the temptation of every man to take revenge on the criminal as the objectification of the sin of his own soul by acknowledging that all men are involved in the guilt of the criminal through their participation in the society which produced him.
3. It must affirm that the function of the state is to promote justice and not to preserve the status quo which

- is in many cases the chief source of injustice and criminal behavior.
4. It must be based on an understanding of God's redemptive purpose for mankind and the realization that only action taken in accordance with that purpose will ultimately succeed.
 5. For this reason it cannot accept the traditional forms of penal practice -- death or mere confinement -- since neither of these is suitable to the purpose of redemption. Neither can it accept that contemporary concept of treatment which denies the freedom of the human will and its own responsible role in its redemption.
 6. It must recognize that God's way of dealing with erring human beings has been to establish redemptive community with them through historic covenants, and that it is the nature of such community to accept men as they are in the knowledge that they can become what they are meant to be only as they are encouraged to use what they are now for the common good.
 7. It must satisfy the fundamental and legitimate needs of society, of the victim, and of the wrongdoer himself for punishment of crime by non-retributive means.
 8. It must express Christian forgiveness of the criminal in its willingness to share the costliness of crime by taking steps to prevent further crime and to improve the present penal system.
 9. For further definition of a Christian philosophy of penal justice, certain problems indicated in this present study must be subjected to careful research.

256 pages. \$3.30. Mic 57-2595

**WILLIAM FAIRFIELD WARREN:
METHODIST THEOLOGIAN**

(Publication No. 21,547)

Howard Eugene Hunter, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor L. Harold DeWolf

This dissertation sets forth data and interpretation for an evaluation of the significance of the life and work of William Fairfield Warren to the theology of American Methodism. The method employed is that of an "intellectual biography" in which Warren's achievements are delineated against the background of his life and times. The sources used are mainly primary.

Following a chapter of biography a survey is made of Warren's early works. His response to the theological climate of mid-nineteenth century New England is seen to be characteristic of American Methodism of that period. Warren's scholarship in the areas of cosmology, comparative religion, and the history, psychology, and philosophy of religion is examined. His standpoint is seen to be that of Christian theism which he conceived to be the highest, deepest, and most scientific of positions. He understood the wellsprings of all religion and theology to lie in the incompatibility within each individual of instinctive awareness of absolute dependence and of spontaneous energy.

He argued that religion can and must pass before the strictest and most thorough scientific investigation.

The heart of Warren's theology lay in his conviction of the identity of ideal Christianity with ideal Religion. The God postulated by philosophical and scientific researches is identical with the God revealed by Jesus Christ. One-sided emphases on either "divine revelation" or "purely natural evolution" are joined together in a third view which seeks to harmonize the two by showing that the essence of religion implies a mutual activity on the part of the Divine Object and the human subject.

Remaining loyal to what he held to be the authentic Methodist interpretation of an evangelical and orthodox Gospel, Warren demonstrated a deep concern for maintaining the relevance of the Christian message to a rapidly and radically changing scientific, philosophical, and cultural context. His work, *Systematische Theologie*, was hailed as a noble beginning of a statement and vindication of Methodism. It championed Methodism as the only fully Scriptural and fully reasonable theological position. It remained unfinished, however, because of Warren's many duties as founder and President of Boston University as well as professor and Dean of the School of Theology. A chapter is devoted to Warren's theologically significant educational work.

Widespread suspicion of theological education characteristic of much of American Methodism, the poverty of the educational attainment of much of the Methodist ministry, the failure of Methodism's time-honored system of ministerial education to adjust to the demands of a changing social and intellectual context--such factors challenged Warren to shift the center of his career from theology to education. Comprehensiveness, coherence, centrality of personality, a firm foundation of Christian theism in philosophy, and an unwavering commitment to a growing "experimental" type of Christian faith--such were Warren's principal emphases in Methodist education.

A concluding chapter presents a topical outline of Warren's system of religious thought together with an evaluation in historical perspective. Cited as noteworthy are the breadth of his conception of theology, his broad concept of the nature of revelation and stress on the function of rational processes in determining the meaning of inspiration, his insistence upon a median position of pragmatically-qualified evangelical orthodoxy which stressed the twin motifs of his thought: loyalty to the heritage of Methodism and relevance to the demands of the day.

355 pages. \$4.55. Mic 57-2596

**THE TECHNIQUES OF
M. K. GANDHI AS RELIGIOUS**

(Publication No. 21,640)

James Kenneth Mathews, Ph.D.
Columbia University, 1957

The purpose of this study was to examine the techniques used by Mohandas Karamchand Gandhi during his public life in South Africa and India. The particular reference was to determine the extent to which these techniques might be termed religious.

In pursuit of this aim special care was taken to examine primarily Mr. Gandhi's own writings. The material was vast. He was a prolific writer, the editor of one or more periodicals throughout much of his adult life. Furthermore, his speeches and even many of his conversations were faithfully recorded. Much was, however, not readily available. Moreover, his writings were by his own admission of uneven quality and value. Study of documents was supplemented by travel to Gandhian centers and conversation with some of Mr. Gandhi's relatives and associates.

The outline of treatment emerged only very slowly. Mr. Gandhi did not make an effort to systematize his thought. The techniques which he used, however, lend themselves to analysis and some logical arrangement. This was done, especially with regard to his basic technique, Satyagraha-Truth-force. As conceived and carried out by Mr. Gandhi Satyagraha and its derivative methods are shown clearly to be religious.

Of great importance is the evidence that the determinative force in Mr. Gandhi's life and program was Hinduism. This came as a surprise to the writer who had shared the view widely accepted in the West that if Mr. Gandhi was not essentially Christian, at least Christianity or Western thought was dominant with him. It is believed that this is a significant insight and a corrective to a prevailing understanding of the man.

The view just stated is powerfully reinforced by an elaborate illustration which is at the heart of this study. Very frequently in Mr. Gandhi's discussion of Satyagraha he terms it "infallible" or "invincible." So important is Satyagraha to him that to determine why he asserts its infallibility should be of central significance.

The possibility that Gandhi regarded himself as infallible is easily dismissed by observing how often he admits his failures. Rather, it becomes clear that the infallibility of Satyagraha is based on three typically Hindu concepts. Firstly, the Hindu understanding of truth, satya from sat, "that which exists." Untruth, asatya is non-existent; hence, when truth confronts falsehood, truth must necessarily prevail. Secondly, Satyagraha is based on vajna, "sacrifice" a concept with a long history in Hindu thought as autonomous, unconquerable power. Thirdly, Satyagraha is based on the related idea of tapas, "austerity", again possessing autonomous potency. Gandhi's discussion of Satyagraha is constantly concerned with these three Hindu ideas and is firmly based on them.

Throughout the study Mr. Gandhi's ideas are subjected to criticism. Moreover, the critique of this leader by a number of his contemporaries is reviewed. Latterly, as a popular figure, he enjoyed a somewhat sacrosanct position. During the earlier years of his Indian career, however, he was the target of the frankest criticism. Of importance are these weaknesses: his tendency to impose the ascetic mold on society; his subjectivism; an optimistic view of society and human nature; a tendency to obscure the line between absolute and relative truth. As to his contributions: he did essentially win freedom for India; he prepared his countrymen for freedom; he focused attention on the poor and oppressed and helped them; he developed non-violent resistance into practical mass-methods.

Are his methods universally applicable? He thought so. The indication is that Satyagraha would be effective widely, given a strong moral cause, an adversary to whom moral appeal can be made, a situation in which violence is impossible or imprudent, and non-violent resisters who are disciplined and patient. 225 pages. \$2.95. Mic 57-2597

**GLORY FOR THE LAND: A DRAMA IN
THREE ACTS BASED ON THE EARLY CAREER OF
FRANCIS ASBURY (WITH AN INTRODUCTION
AND EXPLANATORY NOTES)**

(Publication No. 21,548)

Donald McKay Mauck, Ph.D.
Boston University Graduate School, 1957

Major Professor: Dr. Edwin P. Booth

The purpose of this dissertation is to investigate the career of Francis Asbury, the American Methodist Church leader, during the critical years 1771 to 1784 and to create an original historical drama based on this research. The Introduction discusses several issues. Among them are Asbury's place in the development of American religious and secular history, the growing importance of the drama in a recovery of the American historical heritage and in contemporary religious expression, and the problems involved in combining history with effective drama.

Good history and good drama make their peculiar demands upon the writer working in the medium of historical drama. Dramatic license must not result in a distorted view of the events and the persons, and yet there will inevitably be simplification and overstatement in a theatrical grouping of the events. The success or failure of this work depends upon whether or not the presentation is true to the facts, possesses a valid emotional impact, and is actable in terms of stage production.

The play is divided into three acts, with a total of eight scenes. After each scene of the play there is an extensive section of notes showing how the events, speeches, and persons depicted have been based on the historical sources. The notes also include discussions of the liberties taken with the historical facts and the justification of the liberties.

Asbury's published Journal is the major source for a consideration of his career. The notes being prepared for an annotated edition of the Journal by the Association of Methodist Historical Societies were used in the research, as were typescript copies of approximately 350 Asbury letters also being prepared for publication. Other materials employed were the journals of some of Asbury's contemporaries, the published biographies of Asbury, the major Methodist histories of both a general and a regional nature, and numerous accounts of the Revolutionary War period in America.

It is the thesis of the dissertation that the major themes of Asbury's career, which extended from 1771 to 1816, had been developed by 1784. Among these emphases were his dedication to the system of Methodist itineracy, his understanding of America's destiny, the democracy of the Gospel he preached, his autocratic methods of Church administration, and his willingness to suffer for his vocation.

Since it is a common fault of historical drama to become episodic in form, several dominant motifs which can be followed and highlighted throughout the drama have been introduced. They give a unified structure to the play.

1. Asbury's family relationship. Introduced in the opening scene with the conflict between Asbury and his parents over his decision to go to America, the theme is elaborated upon later in the drama by the sub-plot of a conflict between Asbury's American half-brother, Thomas, and his son, Daniel Asbury. In Daniel, Asbury's own conflict is finally resolved.

2. Asbury's struggle against pride. In the first scene, Asbury's father accuses him of excessive pride. This motif is brought to a climax in Act III, Scene ii, where his authority is questioned by James O'Kelly.

3. The challenge of the new nation. This theme is the most dominant one throughout the drama. It progresses in each act as Asbury becomes aware of the growing sense of independence in America, decides to remain here through-

out the Revolution in spite of hostilities, and finally helps mold a new Church preparing to meet the American frontier.

4. Asbury's devotion to his calling. Asbury's personal sacrifices are suggested in the drama, particularly in Act II, as he is left alone in America by the other English Wesleyan preachers.

297 pages. \$3.85. Mic 57-2598

SOCIAL PSYCHOLOGY

SELF, ROLE, AND SATISFACTION

(Publication No. 21,631)

Alfred Laurence Brophy, Ph.D.
Columbia University, 1957

Chairman: Donald E. Super

This study presented a theory of satisfaction that is believed to be relevant to the phenomena both of general happiness and of satisfaction in specific life areas, and tested hypotheses derived from the phenomenological portions of the theory.

In constructing the theory, the importance of considering concepts from manifest and latent levels of perception, as well as from an external frame of reference, was stressed. The theory views satisfaction as a function of the degree of congruence between the concepts of the person and of the environment within the three categories of frame of reference (manifest, latent, and external). A synoptic statement of the theory is that satisfaction is maximized when a person's objectively determined characteristics, his manifest and subliminal perceptions of self, and his manifest and subliminal conceptions of the kind of person he would like to be in fulfilling environmental demands are all congruent, and furthermore are appropriate to the actual environmental situation and to the situation as he perceives it manifestly and subliminally.

The phenomenological portions of the theory tested in the empirical part of the study postulate that satisfaction is a function of the relationship between self concept and manifestly perceived imposed role, and of the relationship between manifest concept of ideal self (or, with respect to a specific activity, manifest concept of ideal role) and manifestly perceived imposed role. In order to test these hypotheses, 81 female nurses were administered questionnaires designed to measure general satisfaction, vocational satisfaction, self concept, ideal self, perceived imposed life role, perceived imposed occupational role, ideal occupational role, self-acceptance, and occupational role acceptance. The magnitude of the discrepancy between designated pairs of the separate concepts was correlated with the satisfaction measures.

General satisfaction was found to be negatively related to the discrepancy between ideal self and imposed life role, and to the discrepancy between self concept and ideal self; vocational satisfaction was found to be negatively related to the discrepancies between self concept and imposed oc-

cupational role, between ideal occupational role and imposed occupational role, between self concept and ideal occupational role, and between self concept and ideal self, and positively related to occupational role acceptance. General satisfaction and vocational satisfaction were also significantly correlated.

The study thus provides evidence of the importance of the compatibility of personal phenomenal concepts and environmentally focused phenomenal concepts as a correlate of satisfaction, and supports the phenomenological portions of the theory of satisfaction that underlay the research.

The study failed to establish a significant correlation between general satisfaction and self-acceptance, as measured by the Bills Index of Adjustment and Values. This finding was tentatively interpreted as a result of the extremely direct nature of the measure of self-acceptance and its consequent vulnerability to processes of defensive denial in the personality.

Finally, it was emphasized that, though phenomenological analysis is important in the understanding of satisfaction feelings, it probably does not by itself provide a sufficient explanatory system. Research on the other, supplementary portions of the general theory of satisfaction was suggested.

76 pages. \$2.00. Mic 57-2599

AN INVESTIGATION ON THE INTERRELATIONS OF REFERENCE GROUPS, MEMBERSHIP GROUPS, AND THE SELF IMAGE: A TEST OF THE COOLEY-MEAD THEORY OF THE SELF

(Publication No. 20,874)

Betty Friedmann Mannheim, Ph.D.
University of Illinois, 1957

This study relates the symbolic interactionist theory of the self developed by Cooley and Mead to current reference group theory. It was noted that the self image of the individual, as discussed by Mead under the concept of "Me," should be affected by the frame of reference which the individual adopts from his major identification reference groups. The frame of reference relevant to the self image is the consensus of the reference group about the self image, and this consensus is presumably perceived by the individual as his Looking Glass Self. It is through the Looking Glass Self that the identification reference group is assumed to influence the self image.

This theoretical approach suggested certain empirical hypotheses. Several of these tested the assumption that identification reference groups affect the self image through the Looking Glass Self to a greater extent than do membership groups (as proposed by Cooley and Mead). Other hypotheses analyzed whether changes in the self image are related to changes in the choice of reference groups. Finally, a hypothesis was tested to determine the extent to which the self image changes in the direction of the Looking Glass Self, which is perceived as being reflected from the dominant reference group.

The subjects of the study were 103 male freshmen, living in groups of sixteen in the University of Illinois housing barracks.

A Reference Group Questionnaire was developed to elicit four major reference group choices of each subject. The subjects also described themselves on four identical self-description schedules, each consisting of twenty pairs of adjectives opposite in meaning and separated by a six-point scale. Each subject described (a) his self image, (b) his ideal self, (c) how he thought the members of his housing barracks saw him (the Membership Group Looking Glass Self), and (d) how he thought his highest ranking reference group would describe him (the Reference Group Looking Glass Self). The subjects also made sociometric choices from among the members of their housing barracks. The whole instrument was administered twice within nine weeks.

The similarities between different self descriptions of each individual and their changes over time were measured by means of the D-statistic. A directional analysis was employed to determine whether shifts in the scale positions on the self image schedule were in the direction of the Looking Glass Self.

It was found that the self image tended to be similar to the Looking Glass Self reflected from the reference group, regardless of whether the individual did or did not consider himself a member of this group. When the individual's membership group and his reference group were identical, the self image was more similar to the Looking Glass Self reflected from it, than when the membership group was not also a reference group. Changes in identification reference groups were associated with changes in the self and ideal self images; changes in the self image were in the direction of the Looking Glass Self which the individual perceived as reflected from his dominant reference group.

These results demonstrate that the symbolic interactionist theory of the self as developed by Cooley and Mead can be operationalized and empirically tested. The findings of our empirical test tended to corroborate the symbolic interactionist position, and led to its refinement and delimitation in terms of certain propositions derived from reference group theory. 123 pages. \$2.00. Mic 57-2600

ADOLESCENT ORIENTATIONS TO CLOTHING: A SOCIAL-PSYCHOLOGICAL INTERPRETATION

(Publication No. 21,393)

Arthur M. Vener, Ph.D.
Michigan State University, 1957

The main problem area of this study was centered around the attempt to explain differences in adolescent clothing orientations within a social-psychological frame of reference. Consideration was given to (1) clothing awareness - level of "sensitivity" to clothing in social life, (2) clothing deprivation - sentiments of adequacy-inadequacy of clothing behavior in respect to other persons, and (3) clothing referents - salient persons referred to in the determination of the legitimacy of clothing behavior. Variations in (1) clothing awareness was examined in terms of differences in (a) sex status, (b) age-grade status, (c) social class status and related variables, and (d) conceptions of self. Some of these variables were also employed to explain differences in (2) clothing deprivation. Specific hypotheses which involved these variables were proposed. A questionnaire was developed in order to test the proposed hypotheses, along with other facets of the problem area, and was administered to a sample group of 8th, 10th, and 12th grade boys and girls in the Lansing school system. A number of operational techniques were used to measure the variables involved and were described in some detail. The statistically significant findings concerning areas (1) clothing awareness and (2) clothing deprivation may be briefly summarized as follows:

1. Girls demonstrate greater clothing awareness than boys.
2. Girls who participate more in organizational activity, i.e., belong to more organizations and hold some official position in these organizations, tend to demonstrate greater clothing awareness.
3. Girls who are more socially confident tend to be less aware of clothing.
4. Boys and girls who are more other-directed tend to be more aware of clothing. For girls alone, the statistical significance of the association and degree of association of these variables is much greater.
5. Boys and girls in higher grades tend to express sentiments of high clothing deprivation less frequently than those in the lower grades.
6. Boys and girls whose fathers are in occupations of higher status tend to express sentiments of high clothing deprivation less frequently than those whose fathers are in occupations of lower status.
7. Boys and girls who participate more in organizational activity tend to express sentiments of high clothing deprivation less frequently than those who are low participators.
8. Boys and girls who demonstrate more social confidence tend to express sentiments of high clothing deprivation less frequently than those who are not as socially confident.
9. Boys who are more aware of clothing tend to express sentiments of high clothing deprivation less frequently than those who are not as aware of clothing.

In respect to personal referents in clothing behavior, it was found that an adolescent's mother and his peers are highly salient referents in decisions dealing with dress selection, while his father is of relatively low saliency. Also, older brothers and sisters prove to be significant referents for those adolescents who have older siblings in their family. In respect to the kinds of persons adolescents aspire to emulate in their patterns of dress, it was established that his peers are selected most frequently. It was also noted that mass-media Hollywood, television, and sports figures have some impact upon adolescent patterns of dress. However, it was concluded that those persons with whom an adolescent interacts on a primary group, face-to-face basis, exert relatively greater influence upon his clothing behavior than those with whom his interaction is of a secondary group, more formal nature.

The association of grade, social class status, and differences in sex with the relative tendency to refer to two highly salient referents, "mother" and peers, in clothing selection decisions was also investigated. The statistically significant findings were: (1) Boys and girls in the lower grades tend to refer to "mother" more frequently than do those in the higher grades; (2) Girls tend to refer to "mother" more frequently than do boys; and (3) Girls in the lower grades tend to refer to their peers more frequently than do girls in the higher grades.

And finally, it was noted that 12th graders as a group, tended to refer less frequently to specific other persons in their responses to the clothing referent items than did the lower graders. It was therefore suggested that by the time the adolescent reaches the 12th grade, clothing norms are effectively internalized. 153 pages. \$2.05. Mic 57-2601

SOCIOLOGY

SOCIOLOGY, GENERAL

OLD AGE: A STUDY OF CHANGE IN STATUS

(Publication No. 21,600)

Zena Smith Blau, Ph.D.
Columbia University, 1957

This study examines the implications that loss of major institutional roles has for the adaptation and interpersonal relationships of older people. It is based on data from two surveys of people over sixty years old in Elmira, New York and in an area of New York City. The two samples contained 968 respondents; in addition, a sample of 257 associates of respondents were interviewed.

Retirement and widowhood have similar kinds of dysfunctional consequences in old age. At each age level, maladaptation occurs more among the retired than among the employed and more among the widowed than among the married. Retired and widowed older persons also tend to have less extensive social relations than the employed and the married. Finally, people who are retired or widowed more often define themselves as old than those who are still engaged in the marital or occupational role, even when age is controlled. However, loss of employment has more pronounced adverse effects on the adaptation and on the self-conception of older people than loss of spouse. Three reasons were suggested for this. First, the fact that retirement results from a social action having invidious implications for the position of the older individual makes it an ego-threat, whereas no similar threat is inherent in widowhood, since it is determined by forces beyond human control. Second, retirement even though culturally patterned often involves a marked discontinuity of role, particularly for men. Third, loss of the work role removes the individual from an important peer group, whereas widowhood signifies the loss of a single, albeit a highly significant, relationship, and a group structure provides better protection against the psychological onset of old age than a single intimate relationship. Indeed, this inter-

pretation is supported by the finding that people who are members of a friendship group less often define themselves as old than those who are not, but the age identification of older people is not affected by the number of friends nor by the frequency of contact they have with their closest friend.

Performance of an institutional role and extensive social relations serve as functional alternatives for adaptation in old age. As long as older people are still married or employed, the degree of their social participation has little bearing on their adaptation, but once they are widowed or retired, their chances of remaining adapted are strongly affected by the extent of their social participation.

Their closest associate influences older people's age identification more than their normative orientation, and relatively isolated oldsters are more influenced by their closest associate than are those who have extensive social relations. These findings suggest that a close associate's influence is greatest in the absence of alternative sources of social support.

Whether or not retirement or widowhood has adverse consequences for social participation depends on its prevalence in the social structure. If such a change in marital or employment status places an individual in a deviant position in his age group, sex group, or socio-economic stratum, it has a detrimental effect on his association with friends. But in sub-groups where the majority are retired or widowed, retirement or widowhood does not have such adverse consequences; indeed, it increases association with friends in some cases. In short, the same social status can have different consequences for the individual depending on its prevalence in the social structure.

181 pages. \$2.40. Mic 57-2602

SOCIAL FACTORS IN PERSONALITY CHANGE

(Publication No. 20,671)

Edward Zicca Dager, Ph.D.
The Ohio State University, 1956

The study is concerned primarily with personality change and the social factors associated with such change. It is a follow-up study based upon a previous mental health survey conducted in 1946, when all third grade students of Miami County, Ohio, were evaluated with a series of tests, among which was the California Test of Personality. The students who were in the third grade in 1946 were, at the time of restudy nine years later, twelfth grade students. All twelfth grade students (576) in Miami County were tested with the same age-graded California Test of Personality in 1955. Of these, 395 had been tested in 1946. The test scores of 1946 were compared with the test scores of 1955 to determine the degree of change. Those students who showed significant changes, both favorable and unfavorable, and those who changed little or not at all were selected for further study. A succession of screening devices with varying degrees of intensiveness were used in an effort to delineate the factors or series of events which seemed to effect a change in personality test scores. In addition to the California Test of Personality, data from incomplete sentence blanks and autobiographies led to the construction of an exhaustive schedule which then was used for further intensive interviewing of ninety subjects of the study. An additional thirty subjects were selected for still more intensive but unstructured interviews that lasted three hours for each subject and were recorded on tape.

The California Test of Personality scores for the high school seniors as a group were higher than they were for the third grade students of 1946 as a group. This is understandable since none of the dropouts were included in the 1955 study. Also, a low correlation was found to exist between the personality scores of those who were tested twice. Almost all of the students changed to some degree, but only 108, or 28 per cent, of the total number of subjects changed in a statistically significant manner. Twice as many changed favorably as changed unfavorably.

The more important results of the study indicate that the following variables are related to change in personality test scores: place of residence, church attendance, affiliation and participation in school and community organizations and activities, social class position, change in economic conditions, and spatial mobility. Other variables are change in family relations, dating relations, freedom and autonomy, work experience, and change in physical appearance. Favorable change is associated with rural residence, higher frequency of church attendance, greater participation in more community and school organizations and activities, higher social class position, improvement in economic conditions, and a low rate of spatial mobility. Those who changed favorably also experienced an improvement in family relations, were not subject to broken homes, had good and frequent dating relations, had the autonomy and freedom appropriate to their age, had more work experience, and felt that their physical appearance had improved over the past nine years.

The findings of the study are conceptualized in terms of interpersonal role theory.

188 pages. \$2.45. Mic 57-2603

ORIENTATIONS TOWARD UNIONISM: AN ATTITUDINAL STUDY OF A LOCAL UNION

(Publication No. 21,051)

Harry Kirk Dansereau, Ph.D.
Michigan State University, 1956

The data for this study were gathered by interviewing one hundred forty-two urban unionists who had been members of a local union for at least three months.

The study of the behavior and attitudes of the members sought first to classify the orientations which the members have toward the local in terms of their expectations of the local's major function. After classification of union orientations, tests were made to determine whether social types related to the orientations could be distinguished according to nineteen selected social characteristics.

Second, the study sought to learn whether there was a relationship between orientation toward unionism and varying degrees of integration at the work plant, neighborhood, and community levels. Third, an attempt was made to ascertain whether active members differed from inactive members in several attitudinal areas. The same test was made in reference to the officers and rank-and-file members.

This research determined the existence of five empirically feasible orientations toward unionism: political, economic, social, apathetic, and hostile. However, little in way of positive conclusions could be reached concerning relationships between the existence of a social type and any given union orientation.

The study showed that those members who exhibited political, economic, and social orientations toward the union were well integrated at the work plant, neighborhood, and community levels of interaction. Apathetic and hostile members seemed less well integrated at those behavioral levels.

The findings of this study indicated that attitudes toward the union, the employers, and union officers, as expressed by members of this local, were very much like those found in other similar studies. This was also true for members' attitudes relating to politics and government. The majority of the members of this local union appeared to be politically conservative and generally favorable toward the union, its efforts and accomplishments.

Those members who were politically, economically, and socially oriented toward the union appeared to be the active members of the union. These latter stood in contrast to the apathetic and hostile members who were inactive. Yet attitudinal differences between active and inactive members were slight.

This study indicated rather conclusively, at least in the local under study, that there was little or no attitudinal cleavage between officers and rank-and-file members. Generally, however, officers showed a slightly higher degree of activity in the local. They were also slightly less critical of the union and somewhat more critical of the employer than the rank-and-file members.

The research pointed to the need for continued study of an institution of such dynamic nature and to the recognition of changing attitudes which may lead to smooth, efficient, democratic functioning of the local union.

257 pages. \$3.35. Mic 57-2604

A STUDY OF POWER IN
A NORTH CENTRAL STATE COMMUNITY
(Publication No. 21,057)

Gerhard Frederick Gettel, Ph.D.
Michigan State University, 1956

The purpose of this thesis has been to explore a particular phase of social organization in an American community -- social power. This study concerns social power as it enters into the making, legitimizing and executing of major policy decisions. Two initial hypotheses were developed: (1) Major policy decisions are made in informal structures and legitimized in formal structures. (2) Economic or financial worth (wealth) is a prime determinant of social power in a community.

This study was conducted in a city of about 60,000 people located in the northwestern part of a north central state. Three sets of interview questions were developed and used with the top ranked power leaders, with sub-leaders and with male heads of households secured through random sampling in selected areas of the community. The writer also lived and worked in the community while the study was made and was, therefore, able to use the participant observation method in addition to personal interviews.

The findings show that both informal and formal structures play an important role in the exercise of social power in a community. Eight cases were selected in which community leaders were engaged in formulating policies; in six of the eight cases important decisions on major issues were made informally by the important community leaders. Major decisions in the remaining two cases were made in the context of formal structures. In all cases legitimization for these decisions occurred in formal community structures. The social facts, therefore, indicate that the first hypothesis is affirmed.

The survey of capacities for decision-making examined eleven relevant bases of social power. Bases of authority were: position, control and length of community residence. Influence bases were access, ability, time, success, community interest, mutual obligations, prestige and wealth. Position and control were found to be highly important bases for authority. The most important influence capacities were found to include access, ability, time, success, community interest, mutual obligations, prestige and wealth. Position and control were found to be highly important bases for authority. The most important influence capacities were found to include access, ability, success and community interest.

Since only five out of the fifteen most prominent community decision-makers were found to be wealthy, the resource of wealth can not be considered as a prime determinant of social power, although wealth must be considered as a minor power resource. The second hypothesis is, therefore, revised.

Based on previous research, and findings of the present study, the following areas for further research are suggested. Empirical investigations on the relationships between the various levels of leadership with the ordinary community residents, and the role of sub-leaders in relation to the most prominent community leaders. A great deal of research is needed in the general area of resources for social power. More field work is required to distinguish legitimization procedures in community decisions.

246 pages. \$3.20. Mic 57-2605

DIFFERENTIAL ACCEPTANCE OF
OCCUPATIONS AS PROFESSIONS

(Publication No. 21,478)
Warren Edward James, Ph.D.
The Ohio State University, 1957

The study was conducted in order to determine the extent to which various occupations are accepted as professions, the criteria employed for their acceptance, and the relationship between the respondent's own occupational prestige status and his (1) readiness to accept occupations as professions and (2) criteria for acceptance of occupations as professions.

The following hypotheses were tested: (1) occupations will vary in their acceptance as professions, constituting a continuous series, (2) the occupational placements of individual respondents will conform to the model for a Guttman scale, (3) readiness to accept occupations as professions will vary with the respondent's own prestige status, (4) criteria for exclusion of occupations from the professions will differ in the frequency with which they are employed, (5) employment of criteria for exclusion of occupations from the professions will vary with the respondent's prestige status, (6) physician roles will differ in the extent to which they are considered professional in character, (7) readiness to accord professionalization to physician roles will vary with the respondent's prestige status.

Data relevant to these hypotheses were collected by means of a questionnaire mailed to a random sample of persons at three occupational prestige levels in the adult male population of Greater Columbus, Ohio. Two-hundred ninety-six usable questionnaires were obtained from the mailing. The main components of the questionnaire were: (1) a list of 99 occupations, (2) a set of thirteen physician roles, (3) a set of instructions for according professionalization to occupations and physician roles, (4) a list of reasons for exclusion of occupations from the professions, and (5) a face sheet concerned with status characteristics of respondents. Preliminary analysis indicated that adequate reliability and validity had been obtained and that sampling bias was probably not high.

The major findings of the study were that (1) occupations vary widely in acceptance as professions, approximating a continuous series; (2) readiness to accept occupations as professions varies inversely with the respondent's prestige status; (3) criteria for exclusion of occupations from the professions vary in the frequency with which they are employed (adequacy of training and talent required being the most frequently employed in all strata); (4) respondents in three prestige strata show considerable agreement about criteria of professionalization, though a few criteria of secondary general importance vary in the extent to which they are employed by different strata; (5) physician roles differ in the extent to which they are viewed as professional, practitioner roles being more accepted than other types; (6) readiness to accept physician roles as professional in character varies directly with the respondent's prestige status; and (7) responses of individuals toward the 99 occupations do not meet the criteria for a Guttman scale but do approximate those of a quasi scale.

The findings did not require complete rejection of any of the major hypotheses. However, the evidence was less

clearly in support of two of them. Although hypothesis two, concerned with the existence of a Guttman scale of occupations, had to be rejected, some evidence for the existence of a quasi scale was present. The fifth hypothesis, concerned with variation in the use of criteria of professionalization among different prestige strata, seemed to hold only for certain criteria of secondary general importance.

The results of the study seem to add further support to the proposition that placement of occupations in socially defined categories is a function of the respondent's own status.

207 pages. \$2.70. Mic 57-2606

**A STUDY OF HIGH SCHOOL DRINKING:
A SOCIOLOGICAL ANALYSIS OF A SYMBOLIC ACT**
(Publication No. 21,068)

George Lamar Maddox, Jr., Ph.D.
Michigan State University, 1956

This is an exploratory study of the pattern, social context and functional significance of the use of beverage alcohol among 1,962 students in the eleventh and twelfth grades of the public schools of a middle-sized American city. Literature on the use of alcohol has concentrated predominantly on "problem" aspects, particularly on the compulsive drinking of the alcoholic. This study approaches drinking as a form of social behavior which, like other social behavior, is culturally defined and socially structured.

Functional analysis and symbolic interaction provide the methodological and theoretical orientations of the research. The principal research instruments were a pre-tested questionnaire and focussed interviews. The questionnaire was administered to all students in the study population. From these, the 177 self-designated "drinkers" were chosen for analysis. Then, a random sample of 179 self-designated "non-drinkers" were drawn. "Drinkers" and "non-drinkers" were compared in terms of a wide range of characteristics with special attention being given to factors of age, sex, socio-economic position, normative judgments about teen-age drinking and to imputed motives for drinking.

The principal statistical measures employed were Chi Square and Kendall's coefficient of rank order correlation (Tau). For depth in analysis, a randomly selected sample of fifty-five students were intensively interviewed. These interviews were tape recorded and later transcribed for detailed analysis.

Conclusions of the study include the following:

1. Drinking among high school teen-agers in the community studies is neither frequent nor intense. Although nine in ten of the sample reported having had at least one experience with alcohol, only one in ten designated himself as a "drinker" and only about one in four reported a pattern of consistent even though generally infrequent drinking. Less than one percent would be classified as "heavy" drinkers. Among those reporting drinking, beer was the only widely used alcoholic beverage.

2. Placing the "drinker" in the social structure, one finds that this person is most likely to be i) male; ii) older; iii) playing or expecting soon to play adult-like

roles; iv) preferring adult models for behavior; v) least active in organized teen-age activities; vi) in the upper or lower strata of socio-economic status and vii) among those reporting a preference and expectations for upward occupational mobility.

3. Although one in ten students was a "drinker," almost half of them conditionally approved of drinking by their age peers. Only one in five unconditionally disapproved. There were shared definitions among all students about the appropriateness and inappropriateness of the what, where, when, how much and with whom of drinking.

4. The functions of teen-age drinking suggested by the analysis are i) status-conferral (e.g., some drinking serves as an improvised rite of passage between the adolescent age grade, perceived as predominantly abstinent, and the adult age grade, perceived as predominantly non-abstinent); ii) group identification (e.g., identifying oneself and being identified as a member of a group oriented to playing adult-like roles); iii) anticipatory socialization (e.g., parentally approved but controlled exploration of adult drinking behavior by adolescents; and iv) legitimization of unconventional behavior (e.g., behavior which is tolerated because one "does not know what he is doing" so that the projected irresponsibility is sometimes fulfilled even when the behavior cannot be explained by the actual ingestion of alcohol).

The significance of the data for sociological theories of symbolism in relation to action, age grading in relation to social structure, social norms in relation to behavior and motivation are briefly explored.

255 pages. \$3.30. Mic 57-2607

SOCIOLOGY, FAMILY

**A CONTENT ANALYSIS OF SELECTED
FAMILY LIFE EDUCATION TEXTBOOKS USED
AT THE SECONDARY LEVEL**

(Publication No. 21,439)

John William Hudson, Ph.D.
The Ohio State University, 1956

With today's increasing emphasis at the secondary level on American family life education, the textbook in this field occupies an important place. Ten high-school textbooks, published from 1945 to 1954, were analyzed in the study.

Three questions were investigated:

1. What is the concept of family life described?
2. What types of subject matter are treated?
3. What sources are used to establish the concept of family life, i.e., what sources do the authors use in presenting their particular point of view?

Content analysis was the method used. The contents of the textbooks were analyzed in terms of 10 major categories and one miscellaneous category containing 14 subdivisions. The 10 major content categories covered 91.8 per cent of the total contents. The miscellaneous category permitted the scoring of special content areas appearing in some textbooks. Footnotes and suggested readings were

tabulated and analyzed according to each author's field of specialization.

Content analysis revealed lack of agreement regarding the proper subject matter of high-school textbooks in family life education, as well as lack of consensus regarding relative space apportionment to the topics treated.

Three subject-matter areas were included in all textbooks, namely, family life, personality development, and dating. The subject of sex, generally assumed to be of particular interest to high-school students, was treated in only three textbooks.

Half the textbooks contained footnote references. These references represented 18 fields of specialization, of which sociology, home economics, education, and psychology accounted for 59 per cent. Considerable variation is shown in the use made of suggested readings. The readings examined represented 25 fields of specialization, with home economics, psychology, and education dominant. Such fields as sociology, family life education, and disciplines concerned with socialization were less well represented. In general, the suggested readings were up to date.

A qualitative analysis revealed the "textbook family" to be democratic, middle class, and upwardly mobile, placing a high value on adjustment, "good" personality, and cleanliness, and having few major conflicts or crises.

133 pages. \$2.00. Mic 57-2608

SOCIOLOGY, RACE QUESTION

DYNAMICS OF CRIMINAL LAW ADMINISTRATION IN A BIRACIAL COMMUNITY OF THE DEEP SOUTH

(Publication No. 17,983)

James DeVaughn Turner, Ph.D.
Indiana University, 1956

This study is the result of field research in a community of the State of Mississippi. The primary objective of the research was to learn of any significant modifications

in the differential implementation of the criminal law to white and Negro persons which may have occurred as a result of, or in conjunction with, the upheavals characteristic of the time period consumed by World War II. And, as a corollary, if such changes became apparent, the study plan anticipated attempts to interpret and evaluate the significance of these phenomena.

The basic plan of the study involves the comparison of similar data obtained from a single community during two different time periods. One of the time periods is a five-year span before World War II and the second is an identical duration of time after the war. Two principal methods are employed in the field research: direct observation of the various processes of criminal law administration, and intensive case analysis. In the latter, particular emphasis is placed on the identity and social status of the person or persons, both actor and victim, involved in felony charges lodged during the time periods selected for study.

The data obtained indicate that significant changes in the administration of criminal law have occurred in the community studied over the time covered by the survey. The trend of changes observed, with one exception, points toward a more uniform administration of the criminal law regardless of the social status of those involved. The lone exception is found in those inter-racial offenses where the Negro is the victim. Apparently the long-established taboo against convicting a white person for crime against a Negro remains substantially unmodified. The greatest change observed is found among Negro intra-racial offenses. This change was so extensive that, if this community is representative of the larger community, i.e., the Deep South, the criminological truism that the Negro person remains relatively unprotected by the criminal law from the offenses of other Negroes is no longer valid. It is most certainly not valid in the community studied.

The general conclusion is that, as jury and court decisions of this nature are subject to localized social control by the white population only, the changes observed are of fundamental importance in indicating significant changes in the attitudes and values of the white population of the community. If the observations of the writer are valid, then important changes with respect to the protection of the person of the Negro from criminal action by whites may be expected to appear in the near future.

174 pages. \$2.30. Mic 57-2609

SPEECH-THEATER

THEATRICAL MOVEMENTS IN THE THEATRE ARTS MAGAZINE FROM 1916 TO 1948: A DESCRIPTION AND ANALYSIS

(Publication No. 21,701)

George Newton Gordon, Ph.D.
New York University, 1957

The document consists of a description and analysis of the Theatre Arts magazine with special reference to its treatment of the rise of theatrical movements in the United

States from 1916 to 1948. The periodical studied was one of the longest lived and most highly respected theatre journals printed in the United States, according to historians and critics.

The study attempts to test the hypotheses that, 1) the publication provided an accurate overall picture of the development of theatrical movements in the United States; 2) it anticipated the rise of these movements; and 3) it is possible to yield a definite statement in regard to the educational significance of the magazine.

In Part I of the study, which was based on secondary

data, the following five major categories of American theatrical movements are identified and described: 1) the little theatre movement; 2) the educational theatre movement; 3) the rise of professional producing organizations; 4) the development of aesthetic theories of theatre; and 5) movements in American drama.

In Part II the contents of Theatre Arts are described and analyzed according to their significance in relation to the material found in Part I. Material not relevant to Part I is delimited from the study. This analysis is based upon the following criteria: 1) similarity and dissimilarity of material in Theatre Arts as against the secondary sources, including a) the nature of the recognition of theatrical movements in both media, b) disregard of movements current in the American theatre by the publication, c) identification of the magazine's special enthusiasms, and d) coverage of trends and changes in theatrical movements in the publication as compared with the secondary sources; 2) the quantitative nature of the magazine's interest in these movements; and 3) the significance of when this interest appeared.

The study shows that treatment of theatrical movements in Theatre Arts conformed, in general, to the pattern of movements as treated in the secondary sources with the following exceptions: the publication had little regard for social theatre, theatre for sociological or psychological purposes, educational theatre in primary and secondary theatre and children's theatre. Declining interest in theatre aesthetics is noted after 1930, with a concomitant increase in interest in practical and popular aspects of theatre art. The magazine displayed a consistent enthusiasm for its own concept of the tributary theatre, and, in the nineteen-twenties and 'thirties, favored regional and American Indian drama, although little interest in these ideas was found in the secondary sources.

The first hypothesis of the study, that Theatre Arts provided an accurate overall picture of theatrical movements in America, is validated with certain exceptions, noted in the paragraph above, which do not appear to overbalance the publication's success in observation and description. The second hypothesis, that the publication anticipated these movements, is rejected, since Theatre Arts was more successful at giving publicity to existing movements than at initiating them.

The third hypothesis, that a recognition of Theatre Arts' nature may yield a definite statement about its educational significance, elicits the following points from the analysis: 1) Theatre Arts was an important tool in educational theatre; 2) the publication had value in regard to creating a record of the history of theatrical movements in America; 3) a need for a publication like Theatre Arts exists in the educational world and in society at large; and 4) the gap left by the demise of Theatre Arts in 1948 has not been filled by another publication.

It is suggested in the conclusion of the study that means of communication transmitting materials relating to the fine arts are significant in education. In our time such transmission has been meagre, particularly in the area of dramatic arts education. The evidence of this inadequacy in the intellectual intercourse of our time and place is interpreted as a challenge to publishers to meet the cultural requirements of an existent public.

379 pages. \$4.85. Mic 57-2610

CERTAIN EFFECTS ON SPEECH OF ALTERATIONS
IN THE AUDITORY FEEDBACK OF
SPEECH DEFECTIVES AND NORMALS

(Publication No. 21,286)

Richard Errol Ham, Ph.D.
Purdue University, 1957

Major Professor: M. D. Steer

Thirty-four subjects, comprising normal-speaking, articulation, phonation, and stuttering groups read a standardized reading passage while certain alterations were made in their external auditory feedback. The conditions were alterations of sound pressure level, transmission time, and width and location of the frequency band. For each of these three alterations there were four sub-levels, totaling twelve conditions. There was also one condition of normal feedback. Speech output was stored by a process of high fidelity recording, and later subjected to laboratory analysis for total speech time, words per minute, phonation/time ratio, mean syllable duration, average speech power and speech power variability. Comparisons were made on the speech output of the aforementioned groups. The speech output of males versus females was also compared on phonation/time ratio, mean syllable duration, average speech power, and speech power variability. Stuttering moments by the stutterers were compared under the various conditions. The data were treated by analysis of variance techniques. Among the statistically significant results, certain interactions between subjects and conditions, or speech variables and conditions seemed worthy of specific mention:

- A. Total speech time:
 - 1. Increased most during the shortest delay times, as compared to other delays and no-alteration.
 - 2. Was longer for stutterers compared to all groups but the phonation Ss.
- B. Words per minute.
 - 1. Were most rapid for the normal group.
 - 2. Were related to different groups' reactions during sidetone spectrum alterations.
- C. Phonation/time ratio.
 - 1. Was highest during delay time of 0.1 sec. as compared to other delay times and no-alteration.
- D. Mean syllable duration.
 - 1. Was higher during spectrum alterations as compared to no-alteration.
 - 2. Was higher during delay times of 0.1 and 0.2 sec. compared to other delay times and no-alteration.
- E. Average Speech power.
 - 1. Was highest for phonation Ss during no-alteration, compared to other groups.
 - 2. Was lowest for phonation Ss during delay, compared to other groups.
 - 3. Was highest for articulation Ss during delay, compared to other groups.
- F. Speech power variability.

1. Decreased during High Pass 1200 cycle filtering compared to Low Pass 600 cycle filtering and no-alteration.
2. Increased during 0.4 and 0.8 sec. delay times compared to other delay times.
- G. Average speech power (males and females).
 1. Higher for males, compared to females, during sound pressure level changes.
 2. Was higher for males as a group.
- H. Stuttering blocks.
 1. Decreased during High Pass 800 cycle filtering as compared to other filter levels and no-alteration.
 2. Decreased during maximal sound pressure level changes compared to other levels and no-alteration.
 3. Was higher in three stutterers, compared to other stutterers, during delay.

It should be remembered that the foregoing results are a sampling, refer only to those found statistically significant, and are not comparisons between major conditions. Within the limits of the investigation it was tentatively concluded that:

- A. Speech groups, compared among themselves and to normal speakers, exhibit certain statistically significant differences in the measured voice variables during alterations of auditory feedback and normal sidetone. They cannot be differentiated consistently over a range of alteration conditions or voice variables.
- B. The effects of major alterations and their sub-levels, in certain instances, are related to statistically significant differences between voice variable measures, by groups and within particular sub-levels of alterations.
- C. Modifications in the number of stuttering blocks can be obtained by alterations in stutterers' external auditory feedback.
- D. There appears to be a limited relationship between modifications of speech output of sex groups in response to alterations of auditory feedback, i.e., there were statistically significant differences for the two groups on average speech power during sound pressure level alterations.

163 pages. \$2.15. Mic 57-2611

PERSUASIVE SPEAKING OF THE IROQUOIS INDIANS AT TREATY COUNCILS: 1678-1776. A STUDY OF TECHNIQUES AS EVIDENCED IN THE OFFICIAL TRANSCRIPTS OF THE INTERPRETERS' TRANSLATIONS.

(Publication No. 21,649)

Wynn Robert Reynolds, Ph.D.
Columbia University, 1957

Chairman: Magdalene Kramer

The purpose of this study is to determine the use, nature, and extent of ethical, pathetic, and logical proof in the translated speeches of the Iroquois Indians at Treaty Councils with the French and the English, held between the years 1678 and 1776.

An examination of pertinent historical data reveals that the culture of the Iroquois afforded the potential speaker numerous opportunities to learn the nature of his audience, to observe speakers, and to practice speaking.

A critical analysis of the official transcripts discloses that several of the orators gained a reputation for eloquence, vocal quality, and the use of appropriate gestures. With but one exception, none of the speakers expressed an awareness of the need to employ rhetorical techniques, although it is apparent from the widespread and continuous utilization of acceptable techniques, and from the deliberate misuse of them, that individual speakers, observing what techniques had been effective in previous speaking situations, had constructed certain rhetorical formulas on the basis of trial and error, and on the basis of their knowledge of human nature. What is not apparent, however, either from the transcripts or from any other source, is the existence of a comprehensive body of rhetorical knowledge common to all speakers.

The speakers manifested a characteristic pattern of good will in the exordia of their speeches. The speakers used expressions of good will in the body of their speeches to mask or to introduce feelings of ill will. The Iroquoian orators appeared to have good sense, never violated the principles of good taste, and employed tact and moderation as frequently as bluntness and overbearance, depending upon the disposition of the speakers and their awareness of what the situation demanded. The speakers revealed a broad familiarity with those subjects that concerned the successful subsistence of their people. The majority of the speakers demonstrated common sense characteristically; they attempted to establish the morality of their people by references to the Deity and their Christian natures, by appeals for churches, ministers, and priests, by demands for the restriction of the sale of liquor, by disassociations from unfavorable impressions, by expressions of noble sentiments, and by assertions of the disability but the sincerity with which they spoke.

The speakers, thoroughly familiar with human nature, employed numerous pathetic appeals, many of which were emotionally loaded. These appeals were never made in the exordia of the speeches and were seldom used in the perorations; pathetic proof, the content of which varied little from speaker to speaker and from decade to decade, was characteristically scattered throughout the body of the speeches. The speakers easily adapted their use of emotional appeals to the varying moods and humors of their audience.

The Iroquois based their logical arguments on assumptions of expediency and self-interest, although the arguments frequently appeared to advance the interests of their audience. Only one moral or humanitarian premise, that of universal brotherhood, was used as the basis of argument. The speakers constructed their arguments inductively and deductively, employing such Aristotelian *topoi* as cause and effect, division, likeness and contrariety, definition, and degree; the speakers refuted arguments by introducing additional evidence contrary to that presented by the opposition, and by resorting to such devices as *reductio ad absurdum* and turning the tables. Although the orators supported their arguments with material drawn from the natural environment, cultural institutions, and experience with the whites, they failed to enlarge upon the fields of knowledge from which they could have drawn a wealth of support because they chose to remain aloof from the more advanced culture of the Europeans.

In their persuasive speaking, the Iroquois gave primary emphasis to ethical proof, employed a considerable amount of pathetic proof, and relied but little on logical arguments.

426 pages. \$5.45. Mic 57-2612

THE RHETORICAL USE OF THE
"AMERICAN VALUE SYSTEM" IN THE
1952 PRESIDENTIAL CAMPAIGN ADDRESSES

(Publication No. 21,583)

Edward Dean Steele, Ph.D.
Stanford University, 1957

The purpose of this study is to discover whether the social science concept of the "American Value System" has utility in the field of public address. This purpose has been accomplished by an examination of a set of representative contemporary speeches. The speeches chosen for this examination are the 1952 Presidential campaign addresses of Adlai E. Stevenson and Dwight D. Eisenhower.

The procedure for this study follows the methods both of content analysis and of rhetorical analysis. For the content analysis, the writer studied descriptions of the American Value System by recognized social scientists to determine the major value orientations. The content of the speeches was analyzed in terms of these categories following the content analysis method recommended by Bernard Berelson. The speeches were then analyzed to

discover the relationship between value orientations and classical principles of rhetoric.

The study shows that the American Value System is an important element in the rhetorical practice of these contemporary speakers. Every category of value orientation is manifested in a substantial proportion of the content of the speeches. Every line of every speech finds a frame of reference within one or more value orientations. It may be the subject; it may be the "universe of discourse" within which the discussion finds meaning; or it may explain why it was said. An orientation may give meaning to words, phrases, sentences, passages, or a speech as a unit. The orientation may appear as a theme, or it may provide the explanations for thematic expressions.

The content is usually oriented by a combination of value orientations. The analysis of these combinations reveals relationships between the orientations, and also reveals the speaker's basic orientation toward action.

The content analysis also shows that the speakers are more alike than they are different in their basic orientation. The difference is one of emphasis on specific orientations, rather than a difference in kind of orientations.

In these speeches, the American Value System provides the criteria influencing choice against which the speaker measures action. It is the criteria for the solution of personal, national, or international problems. Actions in the past, present, or future are criticised in these terms. The question of appropriate criteria is often an issue between the candidates.

The analysis in terms of classical rhetorical principles shows that the orientations of the American Value System are "variables in human nature" to which the speakers adapt their arguments. The orientations provide premises for enthymemes to be used for rhetorical proof. They are the criteria in terms of which character, or *ethos*, is revealed. The speaker stimulates emotion by showing that these orientations will be realized or frustrated by a given course of action. The arrangement of the speeches shows consistent usage of particular orientations in the introduction and conclusion. Stylistic devices are often clues to the presence of value orientations. Devices dependent on the analogical process, including metaphor and humor, often depend on value orientation for meaning.

American value orientations are extensive and important elements in the rhetorical process. This indicates the possibility of the criticism of contemporary public address in terms of the American Value System.

496 pages. \$6.30. Mic 57-2613

ZOOLOGY

A MORPHOLOGICAL AND SEROLOGICAL INVESTIGATION OF HEART SARCOMES; AN ADJUNCT TO THE STUDY OF DIFFERENTIATION

(Publication No. 19,456)

Joseph Finley Albright, Ph.D.
Indiana University, 1956

The morphology of mitochondria isolated in hypertonic sucrose solutions resembles that of mitochondria in cytological preparations. Such preparations are not stable, however, for shortly after isolation the mitochondria undergo structural changes, especially swelling and loss of homogeneity of their optically-dense contents. In biochemical and physiological studies these structural changes seem undesirable when the purpose is to obtain information which pertains to the mitochondria in their native, intact state.

A search was made for factors which promote structural stability of isolated mitochondria as well as for those which favor structural change. The aim was to develop a medium which would support morphological stability for a considerable length of time. Findings which support previous workers were: (1) isolation media best support mitochondrial structure when near neutral pH, whereas, basic or acidic media favor structural changes and aggregation of mitochondria, (2) polyvalent cations favor structural changes and aggregation of mitochondria, (3) versene has a marked effect in promoting structural stability. In addition it was shown that pyrophosphate ion aids in preserving structural stability and strongly inhibits aggregation of isolated mitochondria. Cation exchange resins added to preparations of isolated mitochondria were found to promote aggregation while anion exchange resins had no effect. Dinitrophenol in concentrations as high as 5×10^{-4} M had no effect on mitochondrial structure, while acriflavine promoted aggregation and structural changes and digitonin caused marked structural alterations. A medium containing hypertonic sucrose, versene and pyrophosphate buffered at pH 7.3 was found to maintain structural integrity for six to eight hours at a temperature near 0°C.

The second phase of this work was an analysis of the serological properties of heart mitochondria. The simplest and most easily interpreted serological technique was that of agglutination of isolated mitochondria. Antisera against adult chicken heart mitochondria were prepared in adult rabbits. Freund's adjuvant technique was employed to produce antisera of high titer. The antisera were tested on mitochondria isolated in the medium described above. Pyrophosphate ion, which had been found to inhibit spontaneous aggregation of isolated mitochondria, was especially effective in inhibiting the agglutination of mitochondria by normal rabbit serum. Had this discovery not been made it would have been considerably more difficult to distinguish between the agglutination of mitochondria by normal serum and antiserum.

Antisera were of fairly high titer. Part of the agglutination of mitochondria by these sera was due to hetero- genetic, non-specific antibody. The latter was removed by absorption with chicken erythrocytes. The absorbed sera retained, however, considerable ability to agglutinate mitochondria. Using absorbed sera it was shown that complement did not enhance the agglutination reaction. Absorbed antisera were found to be organ specific to some extent since they did not agglutinate mitochondria isolated from chicken liver. They did, however, agglutinate mitochondria isolated from chicken skeletal muscle and from rat heart muscle.

The absorbed antisera against chicken heart muscle mitochondria reacted strongly with the microsome and supernatant fractions of heart tissue homogenates. They did not, however, react appreciably with the nuclear fraction.

It is felt that appropriate absorptions may lead to the development of antisera which are specific for heart mitochondria. The usefulness of such a specific reagent in serological analyses of the differentiation of heart mitochondria and of the extent to which they participate in heart differentiation is discussed in detail.

The significance of this research lies not so much in the discovery of new facts, but in the development of a new technique which should be useful in the general problem of cytodifferentiation. 65 pages. \$2.00. Mic 57-2614

THE ECOLOGY OF SONIC SCATTERING LAYERS IN THE MONTEREY BAY AREA, CALIFORNIA

(Publication No. 21,564)

Eric George Barham, Ph.D.
Stanford University, 1957

Throughout vast areas of the world's seas acoustic observations have revealed stratified zones of reverberation, which characteristically undergo diurnal migration. Evidence from many sources has indicated that this phenomenon (deep scattering layer) is associated with bathypelagic organisms, primarily the larger crustaceans and midwater fishes. Direct evidence for this is limited, however, and the deep scattering layer has not heretofore been subjected to a long term investigation which would provide data of an ecological nature.

Over a two-year period 85 stations were occupied at the same location off Monterey Bay, California. Acoustic measurements were made with an NMC echo sounder at midday; simultaneously hydrographic data were obtained and net tows were made using conventional equipment and a mid-water trawl.

An analysis of the echograms reveals that while the scattering layer in the area is highly variable, the variations fall within four basic patterns: (1) A single resolved

layer. (2) A thick zone of reverberations contiguous with the outgoing signal resulting in a solid pattern with no distinct layer. (3) A double layer pattern in which the layers are resolved individually at different adjustments of the sounding gear. (4) A double layer pattern with both layers resolved at one instrumental setting.

These midday scattering patterns are so distributed in time that a three-phase annual cycle is evident. Single layers predominate in winter and spring, a solid pattern is present in the summer, and the double layer types dominate in the fall months. Treatment of the hydrographic data indicates that in general the acoustic periods are correlated with distinctive thermal periods, which are explicable in terms of local meteorological conditions. These are considered to be: spring-summer, upwelling; fall, surface warming; winter, low thermal gradient. Studies of phytoplankton samples taken from the upper 10 m. show that phytoplankton blooms follow the upwelling period, and correspond with the periods of solid scattering pattern.

A study of net hauls made above, through, and below scattering layers indicates that no one organism can be assigned sole responsibility for the reverberations in all types of recorded layers. Instead, different species appear to play the dominant role in scattering at different seasons, and some layers probably represent reverberations from more than one species. The major scattering organisms in Monterey Bay appear to be the euphausiid Euphausia pacifica, the midwater prawn Sergestes similis, and the fishes Diaphus theta and Lampanyctus leucopsarus.

In conjunction with data from other sources, these results are drawn upon to construct a theoretical picture of the scattering layer cycle in Monterey Bay; shifts in distribution and population density of these organisms in the scattering layer are related to changes in light and thermal conditions. Variation in size and population density of the crustaceans is also interpreted from the standpoint of their life histories.

192 pages. \$2.50. Mic 57-2615

THE GENUS CARPOPHILUS IN DELAWARE (COLEOPTERA: NITIDULIDAE)

(Publication No. 21,517)

Walter Anthony Connell, Ph.D.
University of Maryland, 1957

Supervisors: Professor Ernest N. Cory and
Associate Professor William E. Bickley

Eleven carpophilids occurring in Delaware were studied together with Carpophilus humeralis (Fabricius), a species found infesting corn in a nearby state. Only humeralis has three abdominal segments exposed behind the elytra. Of three others with fimbriate elytral margins, hemipterus (Linnaeus) has a testaceous apical patch on each elytron, melanopterus Erichson is rufous with piceous elytra and floralis Erichson is uniformly piceous.

Four of the eight remaining have a well-developed post-mesocoxal axillary space. This is punctate only in marginellus Motschulsky. Its hind margin nearly reaches the metepisternal suture at the anterior third in antiquus Melsheimer, while it reaches the suture anterior to the

middle in freemani Dobson and mutilatus Erichson. The pronotal punctures are twice as far apart in freemani as in mutilatus.

Two species are subdepressed. Of these, corticinus Erichson, with subrectangular pronotal hind angles, is castaneo-piceous and brachypterus Say, with these angles nearly rounded, is piceous.

The two remaining are fuscous to piceous and moderately convex. The humeral angles are subrectangular in sayi Parsons and obtuse, or rounded, in lugubris Murray.

The larvae of eight species were studied. Two, floralis and hemipterus, lack meso- and metanotal sclerites. The urogomphi are without lateral spines in floralis. Two, humeralis and antiquus, have conspicuous asperities on the dorsum, but only humeralis has dorsal abdominal sclerites. Only lugubris has ventral thoracic sclerites. The lateral accessory urogomphal spines are very large in melanopterus, but small to moderate in mutilatus and freemani. The urogomphi are blunt in the former and spine-like at the apex in the latter.

There are three larval instars. Prepupal and pupal stages occur in the earth. C. floralis and melanopterus each have a single annual generation, while all of the others have several. Larvae of the former feed in cactus flowers. Development from egg to adult requires an average of 14 days at 80°F. Larvae of melanopterus mine the petals of yucca and development to the adult stage requires an average of 26 days at 82°F.

When reared at 75°F. on dried apricots in glass jars containing wet sand, the average time for development from egg to adult for freemani, humeralis, lugubris, hemipterus and mutilatus was 28, 29, 30, 32, and 34 days, respectively. In each case about half of this time was divided nearly equally into prepupal and pupal periods.

Only lugubris is important in crop production. This species is a primary pest of corn. Varieties with ear tips well-covered by tight husks proved least susceptible. Injury, particularly by the corn earworm, increased the susceptibility by making the kernels more readily accessible. C. lugubris overwinters as a larva and adult in the earth under surface debris and, also, as an adult in protected places above ground. The recent increased abundance of this species has followed changes in corn cultural practices that have increased its food supply. These are associated with mechanical harvesting and are, specifically, grower preference for easily harvested loose-husked varieties and the quantity of refuse ears which the mechanical picker scatters over the surface of fields.

C. mutilatus, rare in Delaware, and freemani have long been confused with dimidiatus Fabricius. C. freemani was found most abundantly in moldy kernels and old earworm frass on mature corn ears.

C. antiquus was found to be associated with corn, in relatively small numbers, throughout the year. Adults fed on pollen and earworm frass. Larvae were found in rotting ears in the soil. The life cycle was completed in about six weeks at summer temperatures. The reproductive rate appeared to be low.

113 pages. \$2.00. Mic 57-2616

SOME ASPECTS OF THE ECOLOGY OF ENDOPARASITES OF BEEF CATTLE IN KANSAS

(Publication No. 21,751)

Leonard Wesley Dewhirst, Ph.D.
Kansas State College, 1957

While Kansas beef cattle are not generally subject to clinical parasitism, the actual extent of infection has been largely conjecture. The present study was initiated to: (a) develop better methods of studying internal parasites of cattle, (b) determine the extent of parasitism, (c) ascertain seasonal fluctuations in parasitosis and, if possible, relate the same to climatic phenomena, (d) determine ratios between actual worm burdens and the number of ova passed in the feces and (e) make recommendations in management practices which might decrease parasitosis in beef cattle.

Continuous weather records were maintained by means of a recording soil thermograph, a recording hygrothermograph and a recording rain and snow gauge.

Egg per gram (EPG) counts on fecal material from calves born in the spring of 1952 and 1953 were conducted weekly from birth to the age of two years. Calves born in 1954 were studied similarly but for only one year. Cows were sampled monthly for approximately one year.

Samples were prepared individually using a flotation technique and EPG counts were made to determine the number and kind of parasite ova that were present.

Results of the weekly EPG counts showed that the rate of infection in beef cattle from the Flint Hills region of Kansas was fairly low but was not constant. Egg counts were low in spring-born calves until the first winter when they started to rise reaching a peak in early spring. This peak EPG count was shown to be significantly higher by statistical means than any other EPG counts recorded for those calves. The "spring rise" was related to increasing temperatures as shown by soil temperatures. Following the "spring peak" the EPG counts dropped sharply. This drop coincided with the time the calves were placed on summer pasture.

The Cooperia-Ostertagia-Trichostrongylus group, the Haemonchus-Oesophagostomum group and Nematodirus were the most numerous parasites present and contributed most to the "spring rise". Bunostomum, Trichuris and Moniezia were present in low numbers throughout the year. Coccidia were encountered throughout the year but were numerous only in the young calves. Counts on the cows were consistently low and showed no seasonal tendencies.

To determine the ratio between EPG counts and actual worm burden present, a total of 20 calves was slaughtered at varying times during the year, EPG counts were conducted, all parasites were recovered from the abomasum and intestines and ratios were computed. To determine the number of parasites present in an animal at post mortem, a method using an agitator type washing machine for mixing the intestinal contents was developed.

These studies showed that the ratio was not the same for all parasites but ranged from approximately one egg in a fecal sample representing 1.3 worms for the Haemonchus-Oesophagostomum group to one worm representing 210 Nematodirus worms. Indications were that the egg production per female worm was not the same at all times but was modified by: (1) the age of the host, (2) the

time of year that the sample was taken and (3) the number of parasites present. In general, the number of parasites required to produce a particular EPG count increased as the host matured.

Management recommendations made which were thought to result in lowered incidence of parasitosis were: (a) the use of a nutritious diet, (b) the use of feed bunks or feed racks for supplemental winter feeding, (c) the use of tanks as a supply of clean water, (d) the use of summer fallowing a winter feed lot or pasture and (e) the use of summer pastures on an alternate yearly basis.

85 pages. \$2.00. Mic 57-2617

THE AMINO ACIDS REQUIRED FOR EGG PRODUCTION IN THE YELLOW FEVER MOSQUITO, *AEDES AEGYPTI* (L.), (DIPTERA: CULICIDAE)

(Publication No. 21,468)

John Barnet Dimond, Ph.D.
The Ohio State University, 1957

Chemically defined media were used in a study of the nutritional requirements for egg production in adult female *Aedes aegypti*. The feeding method was based on the attractiveness of sugar solutions to the mosquitoes. Groups of 400 females were fed from cotton pads which were saturated with the experimental media. Daily counts of egg production were made for a period of 14 days after the initial feeding. The total egg production from the cages of 400 females after 14 days served as the basis of comparison of the experimental diets.

The findings concerning egg production from a basic mixture of 13 amino acids as compared with production when single amino acids were omitted can be summarized as follows. Since no eggs were produced when eight of the acids (arginine, isoleucine, leucine, lysine, phenylalanine, threonine, tryptophane, and valine) were eliminated, these acids were designated as absolutely essential for egg production. The omission of four others (histidine, cystine, methionine, and glutamic acid) resulted in a significant decrease in egg production although some eggs were produced. Subsequent tests showed that histidine and methionine were required for the production of more than a scattering of eggs, and that cystine was essential to maintain a high level of egg production. The stimulatory effect of glutamic acid could be matched by the addition of aspartic acid or ammonium acetate to the diets, but not by the addition of alpha ketoglutaric acid. The beneficial effect of glutamic acid, then, was probably due to its contribution of amino groups rather than to the rest of its molecule, and thus it could not be considered an essential amino acid.

Experiments with the unnatural D isomers of the essential amino acids indicated that the D forms of histidine, methionine, phenylalanine, and tryptophane could be utilized, to a small extent at least, in place of the naturally occurring L forms. The D forms of other amino acids tested could not be used.

In studies on the interaction of amino acids and related materials, it was found that homocysteine and choline, inorganic sulfur, and methionine sulfone would not replace methionine in the diet. Methionine sulfoxide was utilized.

Arginine could be replaced in the diet by citrulline but not by ornithine or proline. Tyrosine would not replace phenylalanine.

There followed attempts to increase the effectiveness of the original control diet by determining the optimum concentrations of each of the essential amino acids for egg production in the mosquito. Three separate series of dose-effect experiments were run with each acid singly. Following each series, the concentrations of each acid resulting in the highest egg production were combined to form a new control medium. The final optimum diet resulted in egg production more than twice that of the original control medium, while the total weight of amino acids was lowered about 25 per cent.

Attempts to increase the effectiveness of the optimum medium by adding non-essential amino acids singly or in groups were unsuccessful. Such additions increased egg production only when added to a quantitatively suboptimal medium.

When beef blood was diluted to a total nitrogen level equal to the optimum amino acid mixture, it appeared that blood was a poor diet for egg production. This was apparently due to the low isoleucine content of beef hemoglobin.

The amino acid requirements of *A. aegypti* for egg production showed great similarity to the requirements which have been determined for growth and maintenance of other animals. Certain slight differences in the adult mosquito's requirements from those of the larvae could be attributed to the non-sterile nature of the adult mosquitoes and their diets or to carry-over of certain nutrients from the larval stage to the adult. 108 pages. \$2.00. Mic 57-2618

The prepatent period was normally 6 to 7 days. Although the patent period varied considerably, it never exceeded 30 days.

Severe symptoms of coccidiosis were not observed, even when large numbers of sporulated oocysts were administered. Greenish diarrhea most frequently gave indication of heavy infection.

All stages of the parasite were found in the intestinal epithelium, and a few coccidia appeared to have penetrated somewhat more deeply.

Periodicity of oocyst production was verified. Most oocysts were given off in feces between 9 A.M. and 3 P.M.

Oocysts were found to sporulate rapidly in 2% potassium dichromate and were capable of infecting pigeons after periods of from 48 hours up to 400 days.

Sporulation in distilled water was greatly reduced, and oocysts were no longer viable after 30 days.

Oocysts could still infect pigeons after 3 days in 20% sodium chloride solution and after 10 days in 15% sodium chloride solution.

Sporulation proceeded well in 2% and 5% hydrochloric acid and in 5% acetic acid. A 2% solution of sodium bicarbonate hindered sporulation, and a 5% solution prevented it entirely.

Oocysts sporulated well in 1% formalin but not at all in 2% and 5% formalin solutions.

Ethyl alcohol in concentrations of 50% and 70% prevented sporulation and killed oocysts within 3 days.

Oocysts were resistant to temperatures of from 0° to 2.5°C. and 3° to 4°C. but did not sporulate. Those at the latter temperature range were still viable after 60 days, while oocysts at the former range were not. Very little sporulation occurred at 35°C. and none at 37°C. or higher.

All oocysts were killed within 96 hours by drying at room temperature.

Sporulation was found to occur equally well in light and darkness.

Anaerobic conditions reduced percentage of sporulation, although some oocysts were still viable after 30 days without oxygen.

Excystation *in vivo* was found to occur principally in the upper intestine of the pigeon, although a few opened oocysts were seen in the gizzard as well. No excystation was observed *in vitro* in trypsin.

There was some evidence of age resistance to *E. labbeana*. A slight short-term immunity following infection was observed in some cases. Multiple doses of sporulated oocysts at 24 hour intervals did not influence the course of infection initiated by the first dose.

Attempts to infect 4 chicks with *E. labbeana* were unsuccessful and 2 pigeons could not be infected with *E. tenella* of chickens.

Coccidia from 5 wild pigeons were found to be morphologically identical with those used throughout the investigation and produced infections similar to the ones being studied.

161 pages. \$2.15. Mic 57-2619

SOME ASPECTS OF THE BIOLOGY OF THE PIGEON COCCIDIUM, *EIMERIA LABBEANA* PINTO, 1928

(Publication No. 21,590)

Stewart Duncan, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Arthur G. Humes

This study was undertaken with the purpose of describing some aspects of the biology of *Eimeria labbeana*, a relatively little-studied but widespread parasite of pigeons, with special emphasis on the resistance of the oocyst to various chemical and physical agents.

Measurements of oocysts collected early and late in the patent period remained relatively constant during the course of infection in most cases. When small oocysts appeared early in the infection, the mean dimensions of those measured later in the patent period of the same infection were larger.

Five pigeons exposed for 24 hours to grain from cages of infected birds became infected. When water transmission was tested, only 1 of 5 birds was infected.

It was found that cleaning cages at 24 hour intervals effectively prevented reinfection. Cleaning at 48 hour intervals did not.

E. labbeana was found in all areas of the lower digestive tract of the pigeon, from just below the gizzard to the rectum. None were seen in the ceca.

THE BIOLOGY AND EXTERNAL ANATOMY OF
ASPHONDYLIA ILCICOLA FOOTE 1953
(DIPTERA: ITONIDIDAE)
(Publication No. 21,521)

Henry Arthur Highland, Ph.D.
University of Maryland, 1957

Supervisor: Ernest N. Cory
Former Head, Department of Entomology

Asphondylia ilicicola Foote, 1953 is a newly discovered midge found inhabiting the berries of the native American holly Ilex opaca Ait. A survey shows that the minimum geographic range of this pest extends from New Jersey to Virginia and West Virginia. To date it has been found only on Ilex opaca, but the host range on horticultural varieties within the species of Ilex opaca is uncertain. Infested berries usually remain green until they drop off the tree, and the ovule within the infested carpillary cavity fails to develop and mature. The berries may be distorted or stunted as a result of the infestation.

The egg is deposited in the young fruit before the petals fall. There is one generation per year, the entire larval and pupal life being spent within the berry. There are three larval instars. In Maryland pupation occurs about the first part of May, and adults emerge during the latter part of May.

A fungus which grew on the walls of the infested carpillary cavity was found in constant association with the larvae. Attempts to culture this fungus on artificial media were unsuccessful.

Observation of partially exposed larvae within the berry revealed that the spatula is used to excavate a tunnel to the integument of the berry. The pupa forms a hole in the integument of the berry through which the adult escapes. The adults are weak fliers and live a short time. A larval parasite Rileya cecidomyiae Ashmead (Hymenoptera: Eurytomidae) was found to attack A. ilicicola. The adult parasite emerges at the same time as the adult midge.

A study was made of the external anatomy of the larva, pupa and adult. This study shows that for the most part the various external structures agree with those described in the literature.

63 pages. \$2.00. Mic 57-2620

A STUDY OF GROWTH AND MOLTING FACTORS
IN COCKROACHES AS INDICATED BY
ALLATECTOMY, SPERMATOGENESIS, AND
INTEGUMENTAL TRANSPLANTS

(Publication No. 21,757)

Gregory Benedict Mulkern, Ph.D.
Kansas State College, 1957

The work reported was a portion of a broad program investigating factors controlling wing dimorphism in cockroaches. In this study integumental tissue was transplanted among several species of cockroaches to determine the effects of the host on the transplanted tissue. In the search for a sex hormone as a possible contributing factor to sexual dimorphism, a study of the reproductive system and factors controlling it was made.

Successful transplants were made among members of 10 genera representing 5 sub-families. Both nymphal and adult tissues were used. A transplant was considered successful when it became incorporated into the body of the host, molted and produced new cuticle synchronously with the host. It was easier to transplant tissue within a sub-family than between sub-families. Intraspecific transplants retained characteristics such as setal arrangement, texture, ecdysial line orientation, and color. Interspecific transplants retained such characteristics except color. The interspecific transplants were lighter than their normal color after the first molt and became lighter still after each successive molt. It was concluded that factors affecting the molting and ecdysial processes are not specific but that the systems responsible for pigmentation are specific.

Live, motile sperm identical in appearance and activity with those of adults were found in last instar nymphs of 9 common species of cockroaches. A more intensive study was made of spermatogenesis for L. maderae. Testis and body size, determined by the distance between the anterior tentorial pits, were correlated. In general, metamorphosing spermatids were not found until the late sixth or seventh instar. Mature, motile sperm were not found until the late eighth and adult instars. Male L. maderae nymphs were allatectomized in the fourth through the eighth instars. Eighth instar nymphs exhibited no externally visible effects when they molted to adults. Seventh instar nymphs gave rise to adultoid forms which closely resembled the normal adult but which were smaller and had short wings, often not fully expanded. Nymphs allatectomized in earlier instars gave rise to adultoid forms which showed varying degrees of development of adult structures. All adultoids had adult integument and inflated wing pads; all had some differentiation of the notal wing processes, axillary sclerites, accessory glands, and external genitalia. No adultoids had active secretion of the accessory glands. No "preadultoids" were produced.

All adultoids showed development of sperm which on a time basis was far ahead of that of normal males. It was concluded that the corpora allata inhibit spermatogenesis and that it is under the same control as the body in general in regard to differentiation and maturation.

A comparative morphological study was made of the corpora cardiaca-allata complex in 10 common species of cockroaches.

A study was made of the mandibular and cervical glands of cockroaches. No specific function was found for these glands.

69 pages. \$2.00. Mic 57-2621

REGENERATION OF THE BRACHIAL SPINAL CORD
AFTER UNILATERAL EXCISION IN EMBRYOS
OF RANA PIPiens

(Publication No. 20,931)

Lee B. Stephens, Jr., Ph.D.
State University of Iowa, 1957

Chairman: Associate Professor J. J. Kollros

Unilateral excisions were made of several segments of the prospective brachial spinal cord of Rana pipiens

embryos at stages 15-23. The animals were fixed between stages 21 and XV.

The initial phases of regeneration depend heavily upon migration of cells from the intact to the operated side, and particularly from the dorsal part of the cord. However, the regenerated side, once partly established, produces new cells for the continuation and completion of the regeneration process through proliferation and differentiation. This mitotic activity is mainly but not exclusively ependymal in position. Moreover, in the younger stages, at least, there is a shifting of ventral cord cells across the ventral midline from the intact side to the side being restored.

The restitution of the excised half of the cord is a gradual process. The variability of restitution is very considerable. Nonetheless, animals operated upon as late as stage 23, as well as those operated upon as early as stage 15, may show complete restitution if given enough time. Because of the variability of restitution greater

restoration for animals operated upon at late stages may be shown than for animals operated upon at early stages, in selected stages in fixation. Although some cases exhibited complete regeneration by stage I, others, including those operated upon at early stages, continue to show incomplete regeneration, even at later periods.

Comparisons of ventricular mitotic density between different regeneration periods reveal a sharp decrease on the control side after 5 days (stages 25-I). Furthermore, comparisons of mitotic density based upon cord volume gave relatively high values in early stages of regeneration, but lower ones in later stages.

In the majority of cases the regenerated half appears histologically complete, except for a decreased number of mesial motor column cells, a lack of Rohon-Beard cells, and larger dorsal column cells.

The spinal ganglia were present on both the regenerated and intact side in the majority of cases.

74 pages. \$2.00. Mic 57-2622

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